1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently this list must be published every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. (In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.)

This document addresses the water bodies in the Beaver-Camas Subbasin that have been placed on Idaho's current §303(d) list.

The overall purpose of the subbasin assessment (SBA) and TMDL is to characterize and document pollutant loads within Beaver-Camas Subbasin. The first portion of this document, the SBA, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Sections 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the Beaver-Camas Subbasin (Section 5).

1.1 Introduction

In 1972, Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Environment Federation 1987, p. 9). The act and the programs it has generated have changed over the years, as experience and perceptions of water quality have changed.

The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to insure "swimmable and fishable" conditions. This goal, along with a 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

Background

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. The Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section 303 of the CWA requires DEQ to adopt water quality standards and to review those standards every three years (EPA must approve Idaho's water quality standards). Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish a TMDL for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the water bodies to meet their designated uses.

These requirements result in a list of impaired waters, called the "§303(d) list." This list describes water bodies not meeting water quality standards. Waters identified on this list require further analysis. A SBA and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the §303(d) list. *The Beaver-Camas Subbasin Assessment and TMDLs* provides this summary for the currently listed waters in the Beaver-Camas Subbasin.

The SBA section of this document (Sections 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the Beaver-Camas Subbasin to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (Water quality planning and management, 40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Some conditions that impair water quality do not receive TMDLs. The EPA does consider certain unnatural conditions, such as flow alteration, human-caused lack of flow, or habitat alteration, that are not the result of the discharge of a specific pollutants as "pollution." However, TMDLs are not required for water bodies impaired by pollution, but not by specific pollutants. A TMDL is only required when a pollutant can be identified and in some way quantified.

Idaho's Role

Idaho adopts water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards and include the following:

- Aquatic life support–cold water, seasonal cold water, warm water, salmonid spawning, modified
- Contact recreation–primary (swimming), secondary (boating)
- Water supply–domestic, agricultural, industrial
- Wildlife habitats
- Aesthetics

The Idaho legislature designates uses for water bodies. Industrial water supply, wildlife habitats, and aesthetics are designated beneficial uses for all water bodies in the state. If a water body is unclassified, then cold water and primary contact recreation are used as additional default designated uses when water bodies are assessed.

A SBA entails analyzing and integrating multiple types of water body data, such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).
- Determine the degree of achievement of biological integrity.
- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.
- Determine the causes and extent of the impairment when water bodies are not attaining water quality standards.

1.2 Physical and Biological Characteristics

The Beaver-Camas Subbasin is located in southeastern Idaho, near the Montana border. This watershed has a complex geologic past that has resulted in the development of a disconnected drainage. Surface water is principally sourced by snow pack, resulting in high runoff peaks in the spring and dry streambed conditions in the fall.

Climate

The climate of Idaho is primarily influenced by air masses moving inland from the Pacific Ocean (Godfrey 1999). Eastern Idaho tends to be more continental in character than western or northern Idaho (Godfrey 1999), resulting in a greater range between winter and summer temperatures. In summer months, rainfall, cloud cover, and relative humidity are at a minimum due to the weakening of the westerly winds, allowing continental climate conditions to prevail. (Abramovich *et al*. 1998)

The main source of Idaho's moisture is the maritime air from the prevailing westerly winds. Precipitation in southeastern Idaho tends to peak twice annually, first in late spring and second in late fall. Summers present the least precipitation, with zero precipitation frequently recorded in August. Convection thunderstorms during spring and summer months also contribute to precipitation in the subbasin. (Abramovich et al. 1998)

Table 1 lists the weather stations in the vicinity of the Beaver-Camas watershed, showing the period over which the station has recorded data, the geographic location of the station, and the elevation at which the station is located. The Kilgore station is the northernmost station in the basin and the Hamer station is the southernmost, as shown in Figure 1. Average summertime temperatures are highest in Hamer averaging 87.7°F in July. Average summertime maximum temperatures occur in Kilgore an averaging 77.6°F in July (Tables 2-4).

Table 1. Weather Stations located in the Beaver-Camas Subbasin.

Station Name	Station ID #	Period of Record	Latitude	Longitude	Elevation (ft)
Dubois Experiment Station	102707	01/01/25 to 12/31/03	44°15’	112°12’	5445
Hamer, 4 NW	103964	10/25/48 to12/31/03	43°58’	112°16’	4790
Kilgore	104908	11/01/60 to 09/03/77	44°24’	111°53’	6160

Tables 2 through 4 provide monthly and annual climate statistics for the three weather stations located in the subbasin. Figures 1 through 3 show average daily temperatures and average daily precipitation for the Dubois, Hamer, and Kilgore weather stations. As shown by the weather stations, temperatures follow the expected pattern, peaking in late July and early August and reaching minimum temperatures in the latter part of December through January. Temperatures are highest in the southern portion of the subbasin, which is a lower elevation and is characterized as a semi-arid steppe. The higher elevations, in the northern portion of the subbasin, experience cooler temperatures (by a rough average of four degrees) in the summer months. Interestingly, mean minimum temperatures are lowest in Dubois, averaging roughly four degrees cooler in than in Kilgore in January.

Precipitation in the watershed varies from nine inches per year in the lower more arid regions to 43 inches per year in the high elevation, mountainous regions along the continental divide (Figure 4). The precipitation is relatively evenly distributed throughout the year with slight increases during the winter and again in May and June. Abramovich et al. (1998) indicate that southeastern Idaho is somewhat unique with these two precipitation peaks as compared to the rest of the state, which typically has one winter peak in precipitation.

The annual average snowfall for the subbasin varies from 28.4 inches in Hamer (Table 3) to 42.8 inches a Kilgore (Table 4) with the majority of the snowfall occurring between November and March. Snow-pack tends to be greatest at the upper end of the subbasin and decreases towards the south, consistent with elevation. Light snowfall begins in September and October throughout the subbasin with snow events continuing through the springtime and ending in June.

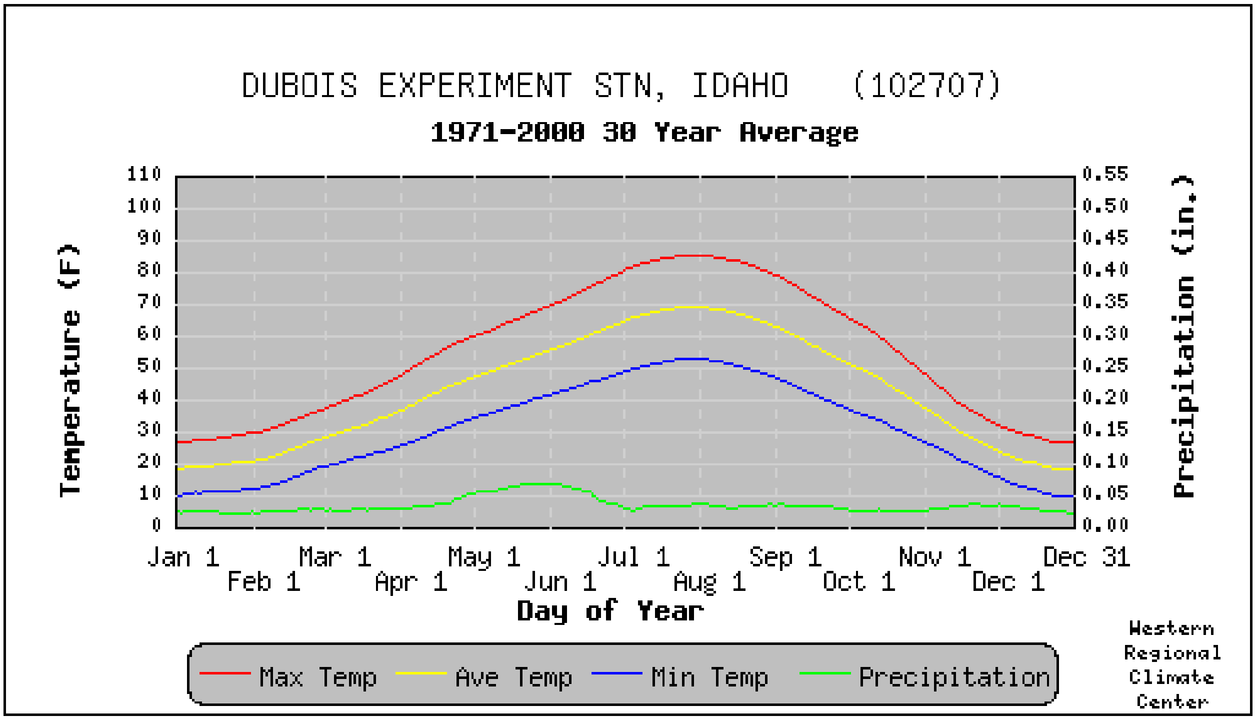


Figure 1. 30-Year Average Daily Temperature and Precipitation for Dubois Weather Station.

Table 2. Period of record monthly climate summary for the Dubois weather station.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Ave Max Temp (°F)	27.1	32	40	54.5	65.5	74.4	85.4	83.8	72.8	58.4	39.7	29.7	55.3
Ave Min Temp (°F)	10.3	14	20.5	29.9	38.3	44.9	52.3	50.5	42.1	32.8	21.6	13.3	30.9
Ave Tot Precip (in)	0.76	0.72	0.75	0.99	1.66	1.75	0.84	0.91	0.88	0.81	0.89	0.9	11.9
Ave Tot Snowfall (in)	10.5	8.9	5.4	2.1	0.9	0.1	0	0	0.1	1.3	6.3	11.9	47.6
Ave Snow Depth (in)	10	13	7	0	0	0	0	0	0	0	1	6	3

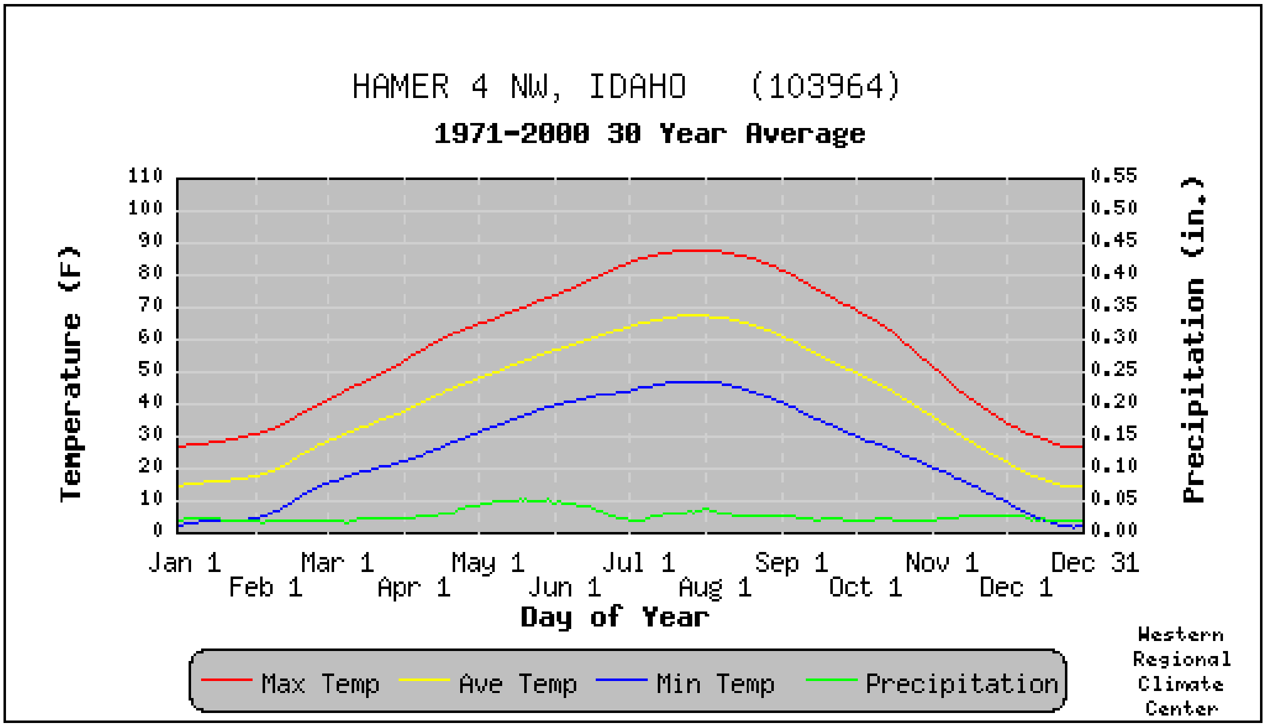


Figure 2. 30-Year Average Daily Temperature and Precipitation for Hamer Weather Station

Table 3. Period of record monthly and annual climate summary for the Hamer weather station.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Ave Max Temp (°F)	28.3	34.6	45.8	59.3	69.7	78.4	87.7	86.3	75.8	62.2	43	30.3	58.4
Ave Min Temp (°F)	4.2	9.7	18.5	27.1	36.1	43	47.8	45.7	36.9	26.6	16.5	6.4	26.5
Ave Tot Precip (in)	0.57	0.48	0.57	0.78	1.36	1.22	0.72	0.70	0.59	0.58	0.66	0.64	8.87
Ave Tot Snowfall (in)	6.8	5.2	2.7	1.1	0.4	0	0	0	0.1	0.8	3.4	8	28.4
Ave Snow Depth (in)	6	5	2	0	0	0	0	0	0	0	0	4	1

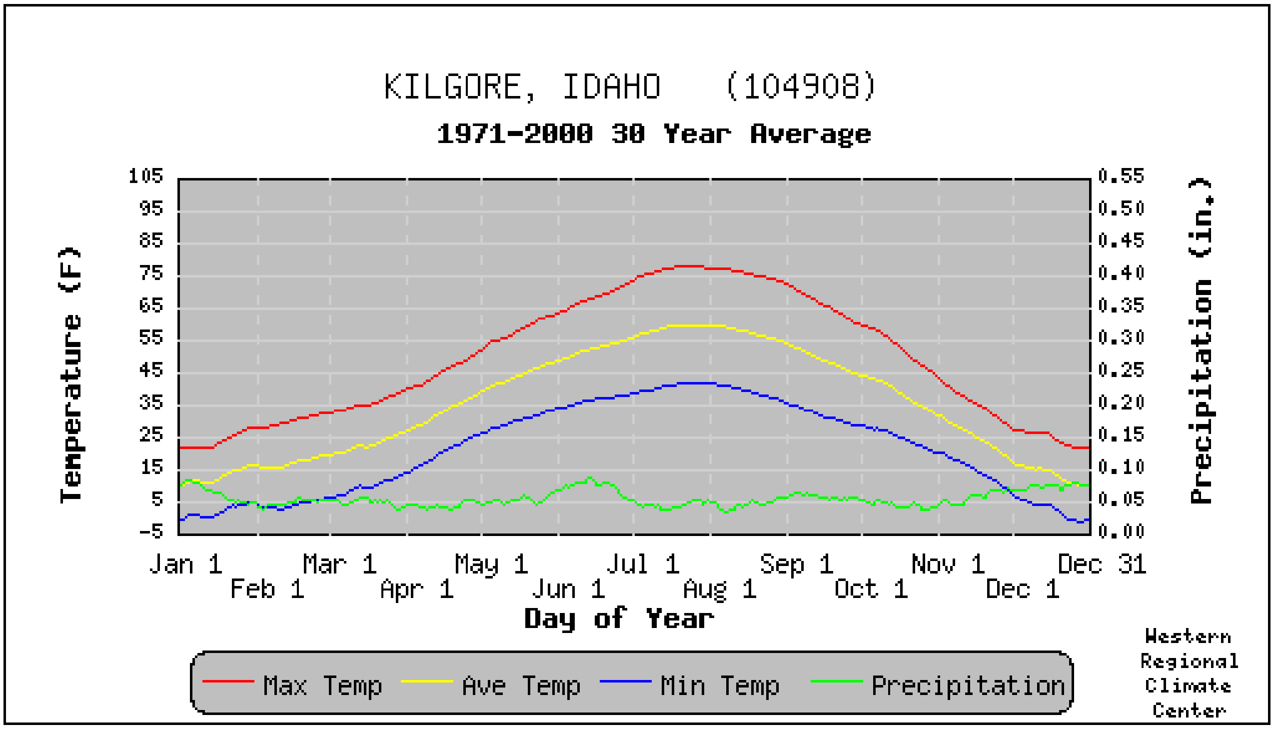


Figure 3. 30-Year Average Daily Temperature and Precipitation for Kilgore Weather Station.

Table 4. Period of record monthly and annual climate summary for the Kilgore Weather Station.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Ave Max Temp (°F)	23.7	30.8	35.3	45.4	58.9	67.4	77.6	76.5	66.1	53.9	36.6	25.9	49.8
Ave Min Temp (°F)	1.9	5	8.3	20.5	30.8	37.3	40.6	39.3	31.9	24.2	15.5	40	21.6
Ave Tot Precip (in)	2.28	1.47	1.53	1.34	1.89	2.93	1.13	1.49	1.62	1.16	1.99	2.3	21.1
Ave Tot Snowfall (in)	28.9	17.1	15.6	9.2	1.3	0.4	0	0	1.4	4.1	19.6	33.9	132
Ave Snow Depth (in)	26	29	32	15	1	0	0	0	0	0	4	15	10

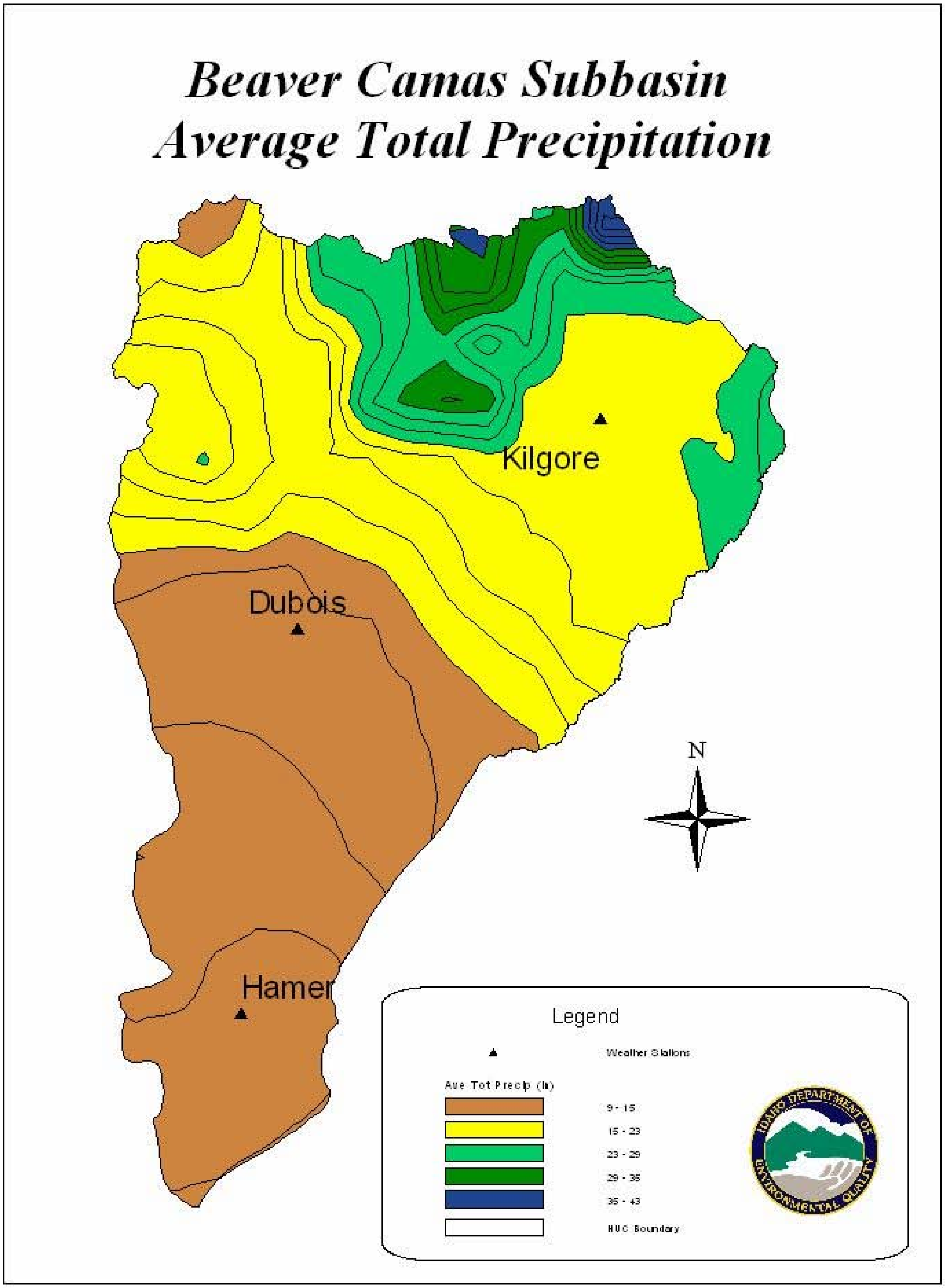


Figure 4. Beaver-Camas Subbasin Total Annual Precipitation and Weather Station Locations.

Air Temperature

Maximum daily air temperatures (°F) were examined at two United States Bureau of Reclamation (BOR) Pacific Northwest Region Hydromet System Data (Agrimet) stations near the Beaver-Camas Subbasin. One station is in Rexburg, Idaho and a second station is in Ashton, Idaho.

For each of these two stations, seven-day moving averages were calculated for all mean daily air temperatures on record (Table 5). From these data, the maximum seven-day moving average was calculated for each year on record. Then the 90th percentile of the maximum annual seven-day averages was calculated. Finally, the number of times the 90th percentile value was exceeded by maximum daily air temperatures was determined for the entire record (minimum of ten years).

The 90th percentile of seven-day moving averages of the maximum daily air temperatures was lowest at Ashton and highest at Rexburg, and the differences are slight but, similar to what might be expected due to differences in elevation.

Table 5. Mean maximum daily air temperature data for two Agrimet Stations.

Ashton, Idaho	
Period of Record	01/01/88 to 12/31/03
90th Percentile of 7-day moving average	96.57°F
Number of times 90th percentile exceeded during period of record	3
Rexburg, Idaho	
Period of Record	01/01/88 to 12/31/03
90th Percentile of 7-day moving average	97.53°F
Number of times 90th percentile exceeded during period of record	4

Snow Water Content

There are two Natural Resources Conservation Service (NRCS) Snotel sites (sites outfitted with special weather stations that measure snow water content) within the vicinity of the Beaver-Camas Subbasin (Figures 5-7). The Island Park site is east of the Subbasin in the Upper Henry's watershed. The other site, Crab Creek, is located in the Beaver-Camas watershed, northwest of Kilgore.

Snotel Graphs shown in Figures 5 through 7 show snow water content at the two sites. The Crab Creek site is newer, with a period of record from 1998 to present whereas the Island Park site's period record is longer, spanning 1983-2004. These graphs show daily average snow water content (heavier blue line) superimposed over the precipitation (green line) and temperature (red line). As illustrated in Figures 5 through 7, snow water content at Island Park was highest in 1983, 1995, and 1997 (25 in) with snow water contents measured above 20 inches. The lowest snow water content years in Island Park occurred in 1997 and 2001 with measurements at or below 10 inches. The Crab Creek monitoring site has limited data with no measurements recorded in 2001, however, from the data at hand, it is shown that the highest snow water content was recorded in 1999 (around 20 in) and the lowest snow water content year recorded was 2003 (around 10 in).

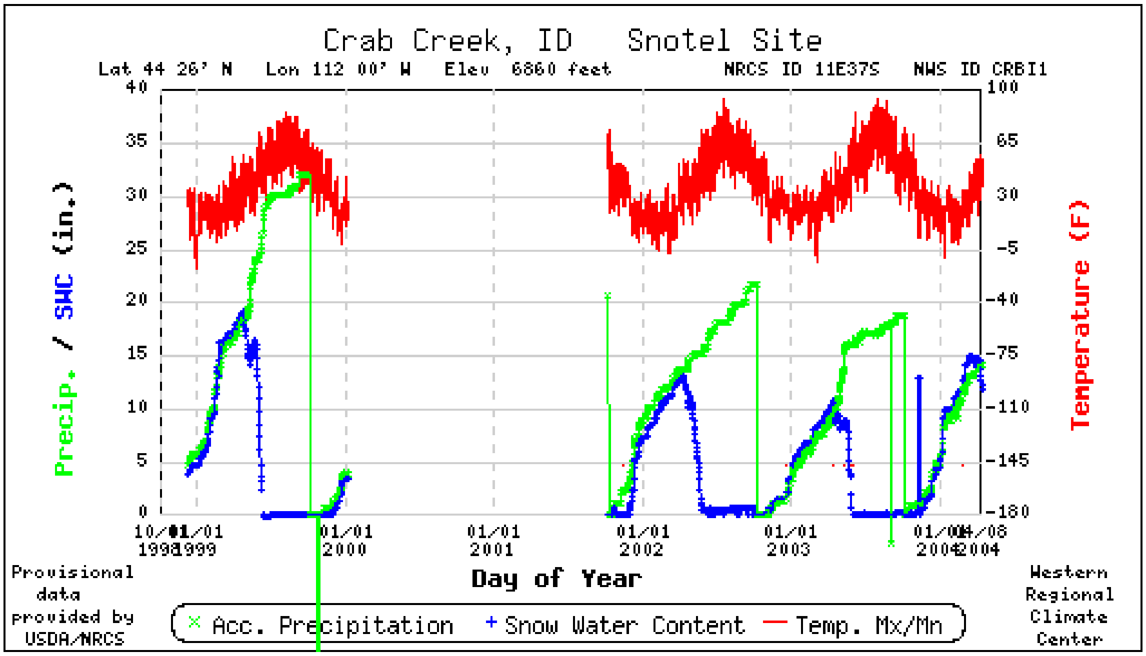


Figure 5. Snotel Graph for Period of Record at the Crab Creek Monitoring site.

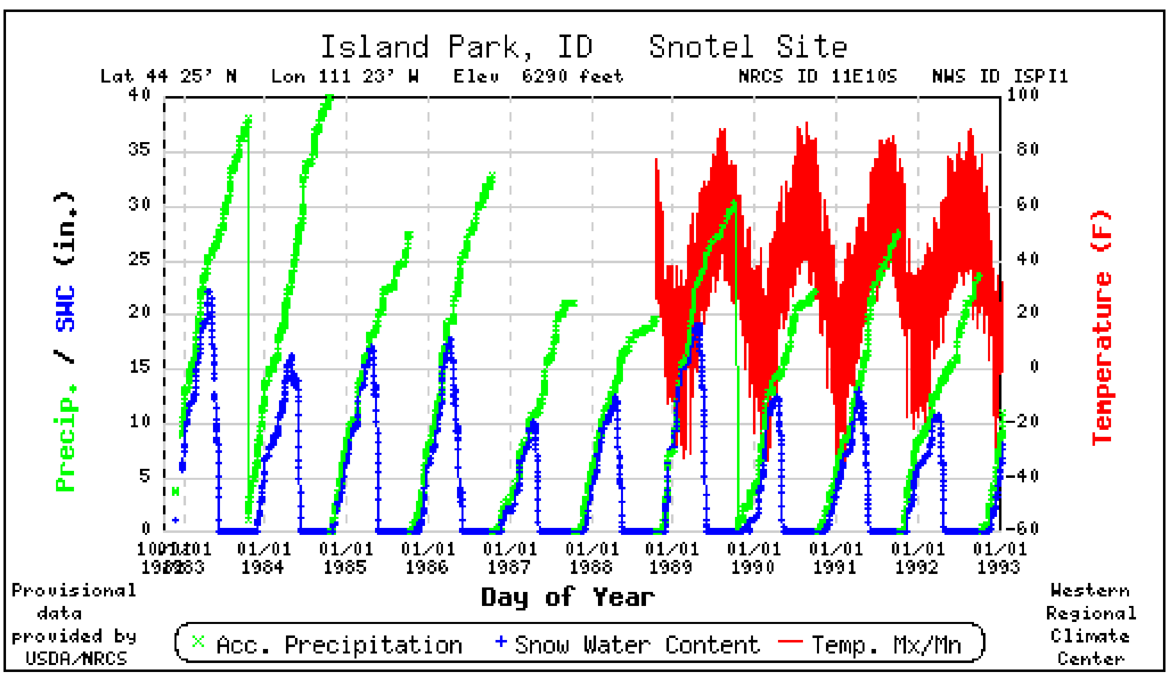


Figure 6. Snotel Graph for 1983 through 1993 at the Island Park Monitoring Site.

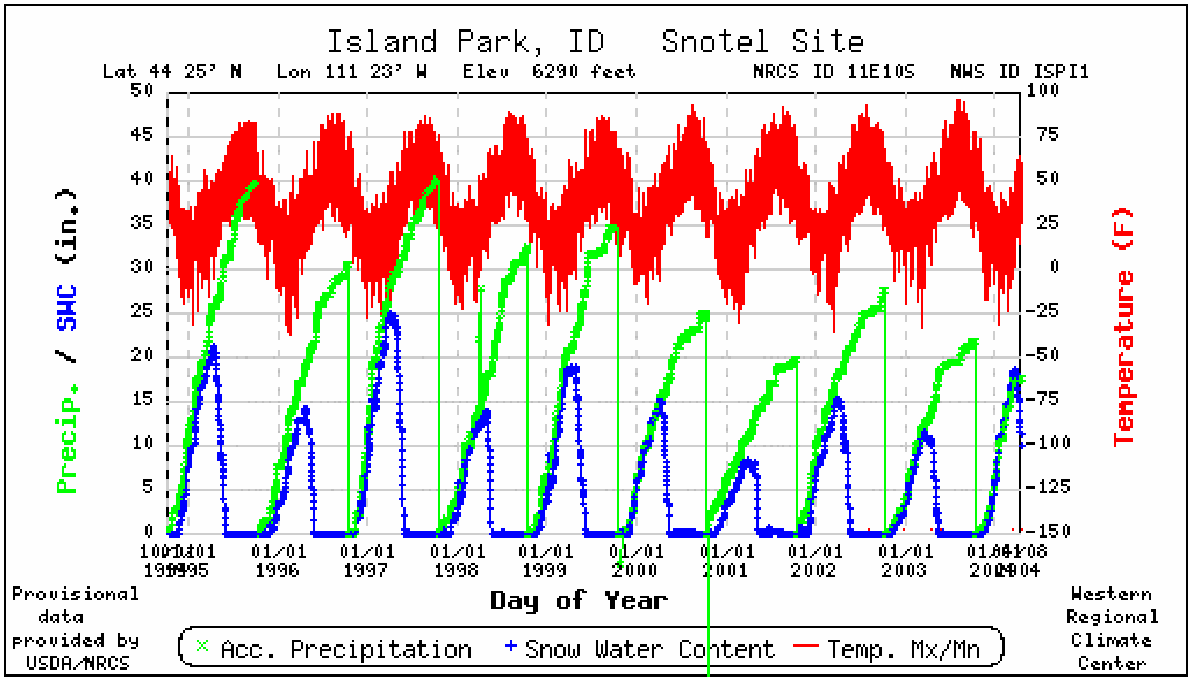


Figure 7. Snotel Graph for the Period of 1994 through 2004 at the Island Park Monitoring Site.

Subbasin Characteristics

Setting and Topography

The topography of southern Idaho is varied and dramatic. The fundamental reasons for this diversity are geological: the recency of volcanism and uplift of ranges along normal faults. This rough topography reflects a complex geologic past.

The Beaver-Camas Watershed is the eastern-most of the local Central Valleys watersheds that collectively make up the Sinks Drainages. The Medicine Lodge Creek, Birch Creek, Little Lost River, and Big Lost River respectively, are located to the west and make up the remaining watersheds of the Sinks Drainages. These watersheds are contained within the Basin and Range province, which occupies a small area of southern Idaho between the Middle Rocky Mountains and the Snake River Plain, west of the northern bound of the Central Rocky Mountains. These are the watersheds that disappear into valley fill material of the longitudinal valleys formed by the Pioneer Range, White Knob Mountains, Lost River Range, Lemhi Range, and the Beaverhead Range of the Basin and Range province.

The Beaver Camas Watershed drains an area of 64,3083 acres (1005 mi^2) bounded by the western edge of the Centennial Mountains and the Eastern Edge of the Beaverhead Mountains in the northern region of the subbasin and drains to the valley floor.

The Beaver-Camas watershed lies in the northeastern corner of the Snake River Plain. The Snake River Plain was formed by the Yellowstone Hot Spot. This is an ancient system of volcanic formations resulting from the North American Plate moving southwest over a stationary-melting anomaly in the earth's mantle commonly referred to as the Yellowstone Hot Spot.

The Hot Spot is characterized by high topography, related to high subsurface heat flow and volcanic activity. The melting anomaly in the mantle results in the inflation, or elevation of the earth's crust, which produces the Continental Divide and also produces other features important to the surrounding hydrology, such as active fault zones, earthquakes, and hot springs (Link 2003). In the wake of the Hot Spot is a path of subsided/deflated terrain that forms the Snake River Plain. This subsidence was due to cooling of the crust and the volcanic infusion of heavy material into the lower and middle crust, resulting in sinking of the Plain relative to the surrounding topography.

As the North American Plate migrated over the Hot Spot, the surface hydrology radiated away from the area of the melting anomaly. This can be seen in the present day location of the Hot Spot in the Yellowstone area, whereas the location of the Hot Spot approximately 6.5 to 10 million years ago would have caused the waters of the Central Valleys to drain northward into the historic Salmon River drainage. This relationship may have caused the Big Lost to drain into the ancestral Salmon River drainage. The Little Lost would have flowed into the ancestral Pahsimeroi subwatershed, and Birch Creek would have flowed into the ancestral Lemhi watershed. In the wake of the Hot Spot, the topography subsided, or deflated, changing the predominant valley slope aspect from north to south and the adjacent Central Valley drainages were captured. The flow from the captured drainages changed to the south, toward the Snake River Plain, isolating the drainages from the ancestral Salmon River creating what we know today as the Sinks Drainages (Link 2003).

Approximately 6,000 years ago, a wetter climate prevailed in this region and, in conjunction with glacial melt off and higher average precipitation, lakes were present in troughs that resulted from the subsidence of the earth's crust. Lake Terreton formed in what is known as the Big Lost Trough. It received the flow of the Big and Little Lost Rivers. Mud Lake formed in the Mud Lake Basin and received flow from Birch, Medicine Lodge, and Camas Creeks. During flood years, the lakes were likely connected with the headwaters of the ancestral Henry's Fork of the Snake River. These connections between the various surface waters of the region could have been the mechanism that inoculated the Sinks Drainages with fish as recently as 5,000 to 6,000 years ago. Today, due to dryer conditions, all that remains of these lakes are the ephemeral playa systems that can be seen from the air over the northern Snake River Plain. The Playas, or lakebeds, as they exist today have been essentially unchanged for approximately 1,000 years (Link 2003).

Volcanic Rift Zones developed when lava flowed down along the axis of the longitudinal valleys of the Big Lost and Little Lost Rivers into the basins in the Snake River Plain that eliminated the connectivity between the trough lakes. The Rift Zones are the linear features that are oriented north to south along the normal faults that form their respective valleys. To the south of the Volcanic Rift Zones are holistic domes that form the buttes that are prominent in the Snake River Plain south of the Lost Rivers. These holistic domes squeezed up through the basaltic lava flows along a feature called the axial volcanic high. The axial volcanic high is 1 million years old, and separates the Sinks drainages from the Snake River Plain and, subsequently, the Snake River.

Geology

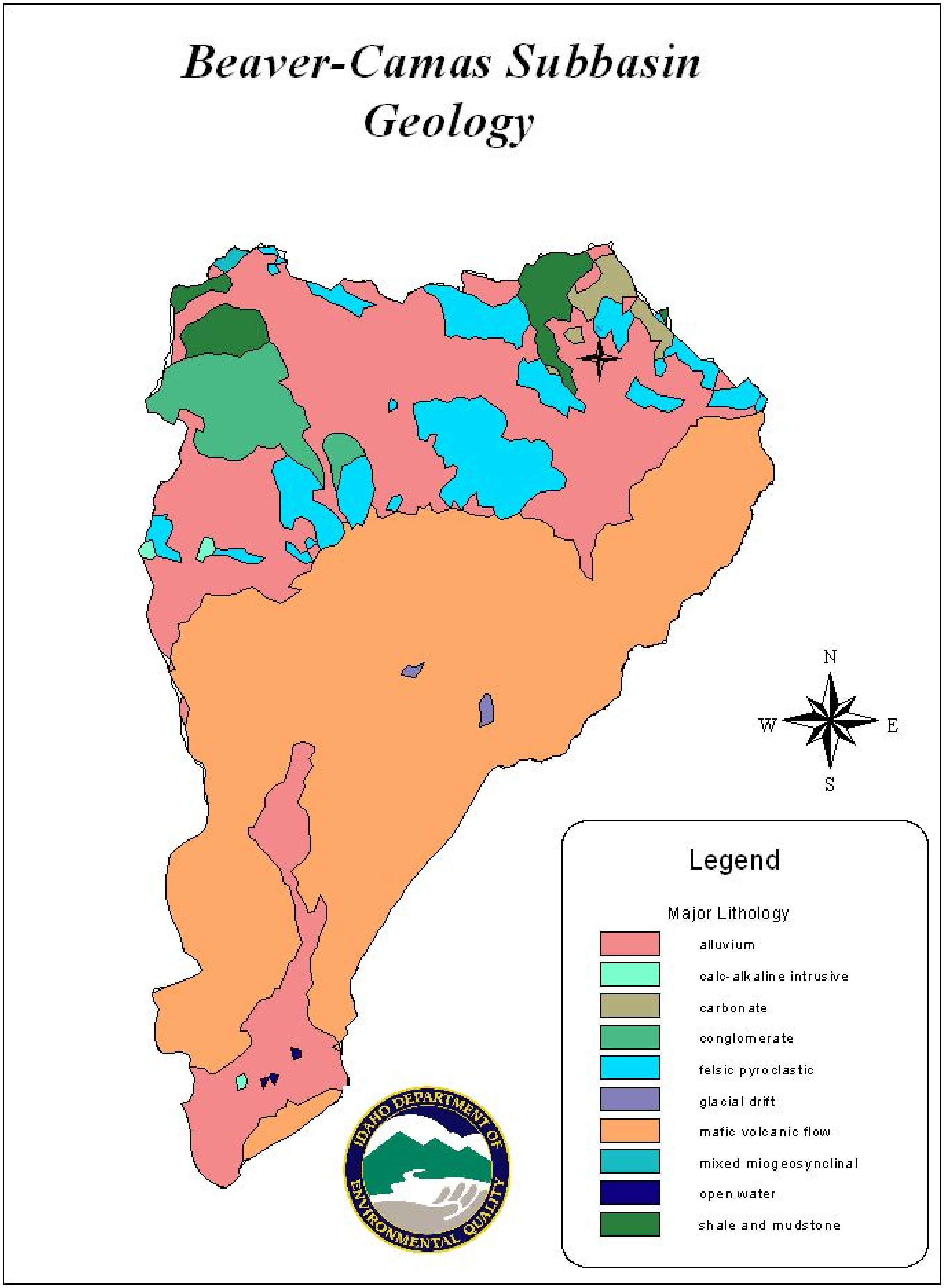
The Beaver-Camas Subbasin includes portions of the Northern Rocky Mountain physiographic province and the Eastern Snake River Plain section of the Colombia Intermountain physiographic province.

The Northern Rocky Mountain physiographic province is characterized by a number of mountain ranges and intervening valleys that have developed on the Idaho batholith and other subsidiary igneous intrusions. These mountain ranges, which include the Beaverhead Range in the northeastern portion of the Subbasin and the Centennial Range in the northwestern portion of the Subbasin, consist of metamorphic and sedimentary rocks of Precambrian to Mesozoic age that have been subjected to intensive uplifting, faulting, and folding. Within the Subbasin, most of these deformed metamorphic and sedimentary units have been covered with a veneer of volcanic hyalite, basalt, and welded tuff. In the late Cenozoic Era, during the later stages of the building of the mountain ranges of the Northern Rocky Mountain province, the mountain province was dissected by an extensive rifting in the earth's crust which created a broad trough that filled with volcanic rocks. This trough, which extends in an accurate pattern across southern Idaho, is known as the Snake River Plain. The basalt flows that underlie the Snake River Plain are many thousands of feet thick. Over much of the southern portion of the subbasin, the basalt has been covered with a veneer of wind blown sediments. In the southern tip of the subbasin, in the Mud Lake/Terre ton area, the basalt has been covered with lake sediments left behind as the Pleistocene age Lake Terre ton evaporated, leaving Mud Lake as its remnant. Figure 8 displays the dominant geology types in the watershed.

Generally, geology in the Beaver-Camas Watershed is volcanic with the exception of a small area in the northern portion of the basin near Monida Pass, which is located at the continental divide on I-15, along the western edge of the Centennial Mountain Range. This portion of the watershed is an assortment of sedimentary formations intruded by granite. (Alt and Hyndman 1989)

The landscape is dominated by more recent basalt lava flows that erupted just thousands of years ago, as the Basin and Range faults formed the Snake River Plain. Basalt flows overlay older rhyolite, a remnant of the passing of the Yellowstone hotspots. (Alt and Hyndman 1989)

Opal, a variety of silica, is located in the northern region of the watershed, east of Spencer. The precious opal found in the Spencer Mines is formed when, "silica gel precipitates very slowly from absolutely quiet water that fills holes deep in the volcanic rock" (Alt and Hyndman 1989, p. 258). Under these conditions, microscopic spheres of silica gel coagulate and line up in rows and layers. This condition creates a prism, diffracting rays of light glistening rainbow colored rays of light.



November 1, 2004

Figure 8. Beaver-Camas Subbasin Geology.

Soils

Soils in the Beaver-Camas subbasin are principally divided into three locales, which strongly correlate with the subbasins' diverse topographic and geologic characteristics. Soils range from silty clay loam in the very southern tip of the watershed, around Mud Lake, to fine sandy loam, in the central portion of the watershed, and to gravely loam in the upper mountainous portion of the watershed. Generally, soils in the watershed are deep to very deep and moderately to excessively well-drained. Soils in the upper watershed, near the continental divide, were formed in loess, influenced by valley side alluvium. In the central portion of the watershed, soils were formed from wind worked materials and Elian deposits overlaying basalt planes. Soils in the lowermost portions of the watershed, near the Mud Lake area, are derived from fluvial and lacustrine deposits.

There are about 643,083 acres within the Beaver-Camas Subbasin delineation. Soils in the project area are described by generalized soil map units called STATSGO Map Units or Map Unit Identification Numbers (MUID), from the **Stat**e **S**oil **Geo**graphic Database. STATSGO is compiled by generalizing more detailed soils maps. The fifteen STATSGO map units (MUID) comprised by this acreage are shown in Figure 9, and are summarized in Table 6. The summary of the STATSGO data found in Table 6 contains average soil slope, soil depth, average K factor, permeability, and percent clay. These are weighted averages for the entire polygon of the MUID.

K-Factor is a measure of erodibility used in the Universal Soil Loss Equation. It measures the tendency of a soil to erode based on the soil texture, organic matter content, soil structure, and permeability. Soils are given a score from 1.0 to 0.1, where 1.0 is extremely erosive and 0.1 is nearly non-erosive. As shown in Figure 10, soils in the watershed have a low to moderate K-factor with the most erosive soils (0.35-0.45) occurring in the northwestern corner of the subbasin (ID172), in the Modoc Creek and upper Beaver Creek watersheds. The least erosive soils (0-0.08) are located in the mountains along the continental divide, where rocky outcrops provide substantial protection against erosive forces. With the exception of the tip of the watershed, at the continental divide, and the base of the watershed at Mud Lake, the soil's erosive potential tends to decrease as one moves down the watershed.

Soil slope represented on STATSGO map units is shown as a percentage in Figure 11. Soil slope is another factor in assessing the erodibility risk of a system. As expected, the steepest slopes in the subbasin were located along the continental divide averaging 52%. Generally, surface slope decreases down the watershed with a surface slope of 0.5% in the Mud Lake area.

Figure 12 depicts soil units on soil depth in inches. The deepest soils are located in MUID ID172, where the headwaters for Beaver Creek and the Modoc Creek drainage are located. The shallowest soils are exhibited in MUID ID165 in the central portion of the watershed where soils are comprised of wind blown deposits on basalt planes.

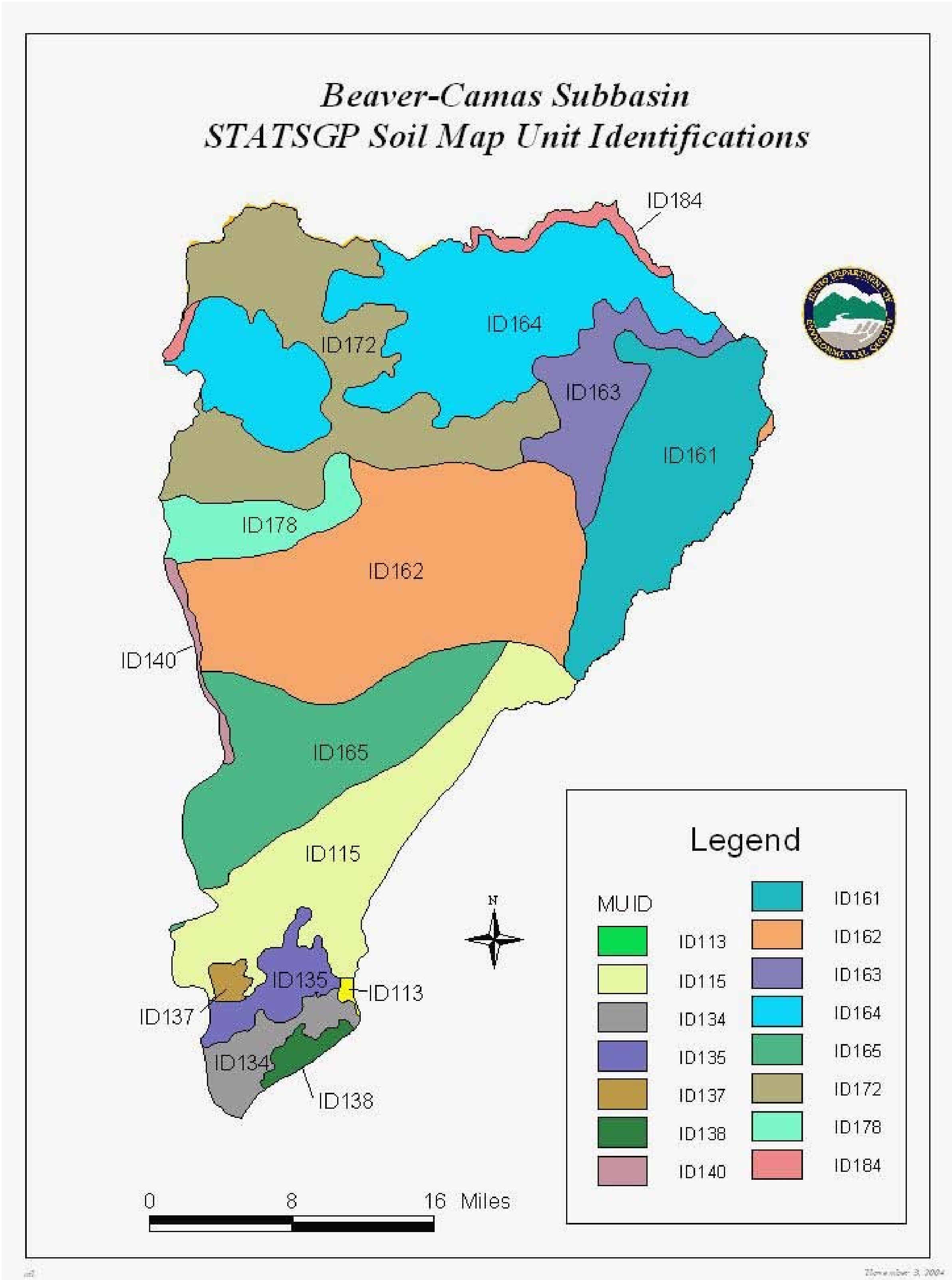


Figure 9. STATSGO Soil Map Unit Identifications.

Table 6. Beaver-Camas STATSGO Soil data Summary.

MUID	Name	Description	Ave Slope (%)	Permeability (in/hr)	Soil Erosion Potential (K-Factor)	%Clay	Thickness (in)
ID113	Rock Outcrop-Bondranch-Modkin	Sandy loam to coarse loam, overlaying basalt bedrock, well drained soils on basalt planes with slopes from 0-30%.	19.5	3.85	0.15	11.3	49.8
ID115	Diston-Grassey Butte-Zwiefel	Sandy, deep to moderately deep, excessively drained soils in eolian deposits of mixed origins on basalt planes.	7.5	8.9	0.12	9.5	57.8
ID134	Terreton-Zwiefel-Montlid	Silty clay loam. Deep moderately well drained soils that formed in lacustrine material. Playas and have slopes from 0-1%.	0.1	1.2	0.33	37.5	60
ID135	Levelton-Medano-Fluvaquents	Fine sandy loam, deep, very poorly drained soils that formed in lacustrine sediments, lakebeds, flood planes and at the ends of alluvial fans.	0.5	3.92	0.24	27.9	60
ID137	Aecet-Rock Outcrop-Bereniceton	Stony sandy loam, moderately deep, well drained soils that developed on lava planes, wind worked material.	17	0.76	0.18	25.1	44.7
ID138	Malm-Matheson-Aecet	Fine sandy loam, deep to moderately deep, well drained soils, on lava planes	8.6	3.4	0.19	16.3	45.8
ID140	Whiteknob-Bereniceton-Medicine	Loam, very deep, well drained, formed in mixed alluvium and wind worked, basalt planes	2.9	10.54	0.21	11.7	59.3
ID161	Katseanes-Vadnais-Rock Outcrop	Silt loam, shallow, well drained soils that formed in loess influenced by valley side alluvium, on basalt planes and hills	18.5	0.46	0.28	21.8	43
ID162	Eaglecone-Vackton-Buist	Very stony loam to gravely loam, very deep, well drained, formed in loess and eolian deposits on basalt, on basalt planes	1.4	4.45	0.33	15.2	56.8
ID163	Fourme-Hagenbarth-Henryslake	Gravely loam, very deep, well drained, formed in alluvium derived from quartzite, limestone and sandstone	2.6	3.78	0.33	21.9	57.7
ID164	Judkins-Stringam-Targhee	Loam to extremely stony loam, moderately deep, well drained soils that formed in material weathered from rhyolite and closely related bedrock	13.5	1.64	0.32	23.3	49.3
ID165	Malm-Bondfarm-Aecet	Fine sandy loam, shallow to moderately deep, well drained soils formed from eolian deposits on lava planes	9.2	2.37	0.19	15.8	37.6
ID172	Parkalley-Latigo-Zeebar	Gravely loam to gravely silt loam, very deep, well drained soils formed from rhyolitic tuff and loess on mountain sides and foothills	25.8	4.61	0.36	18.8	61
ID178	Westindian-Shagel-Deadhorse	Silt loam to gravely silt loam, well drained, moderately deep from alluvium on mountains and foothills	15.3	5.58	0.28	11.5	50.5
ID184	Rock Outcrop-Rubble Land-Cryoborolls	Rocky, well drained, rubble land soils	52.1	6.68	0.07	9.2	54.3

(http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi)

The summary of the STATSGO data found in Table 6 contains average soil slope, soil depth and the average K factor (Hoover 2000). These are weighted averages for the entire polygon of the MUID.

Soil permeability is a measure of the ease in which gases, liquids, or plant roots penetrate a layer of soil. Figure 13 depicts the soil permeability in inches per hour of soil units in the Beaver-Camas Subbasin. The least permeable soils are located in the 1) Thirteen Mile, Rattlesnake, and Corral Creek drainages, 2) in the headwaters of Stoddard and Pleasant Valley Creek drainages, on the eastern border of the watershed in MUID ID161 (0.46 in/hour), and 3) in the Mud Lake vicinity. The most permeable soils are located on the western edge, next to the Medicine Lodge Subbasin, having a permeability of 10.54 in/hour. Soil permeabilities in the remainder of the watershed are somewhere in between 2.7 and 6.68 in/hour.

Figures 14 and 15 show the hydrologic characteristics and soil drainage in the watershed. As expected, the most poorly drained soils in the subbasin occur in and around Mud Lake.

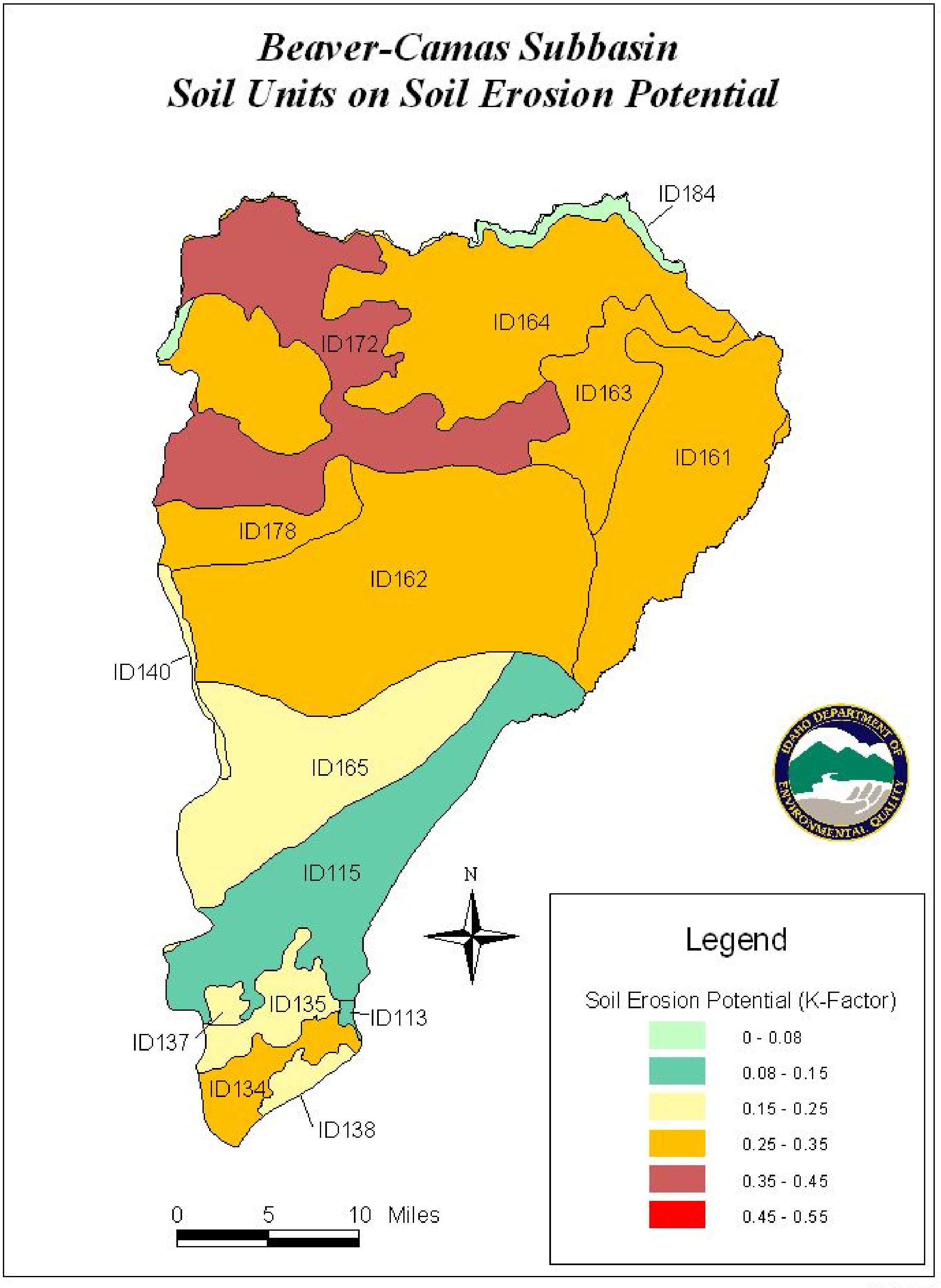


Figure 10. Soil Units on Soil Erosion Potential.

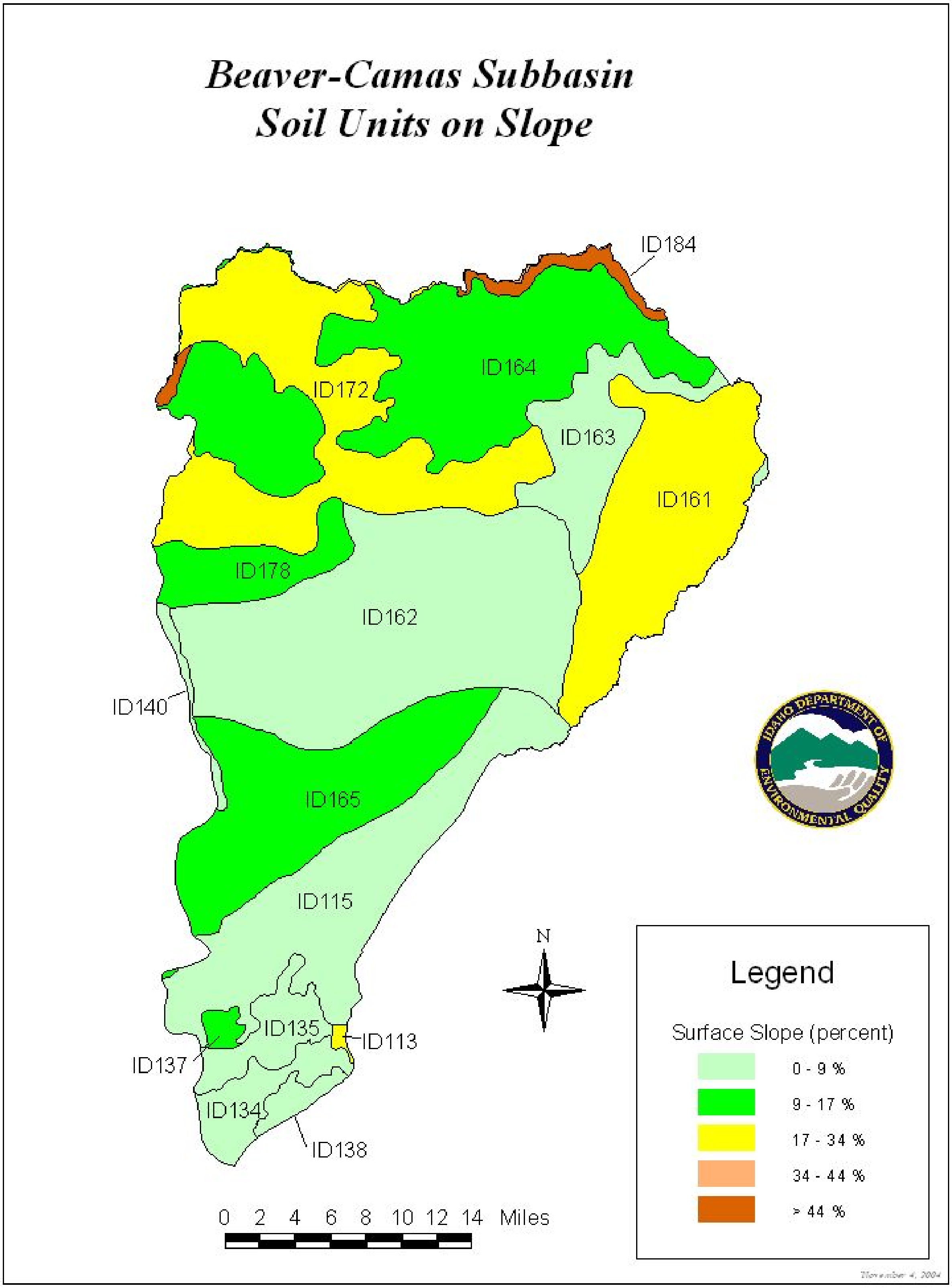


Figure 11. Soil Units on Slope.

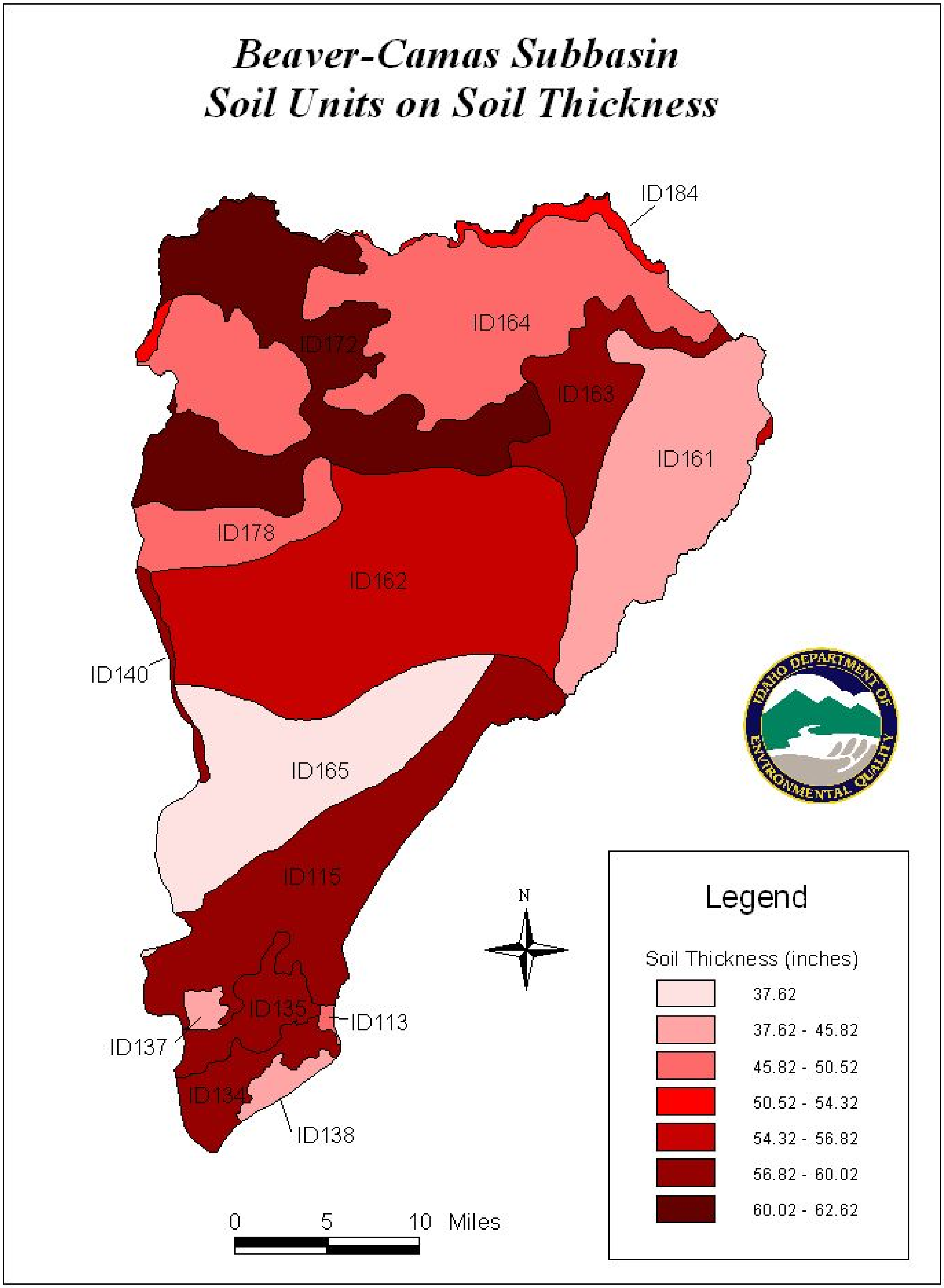


Figure 12. Soil Units on Soil Thickness.

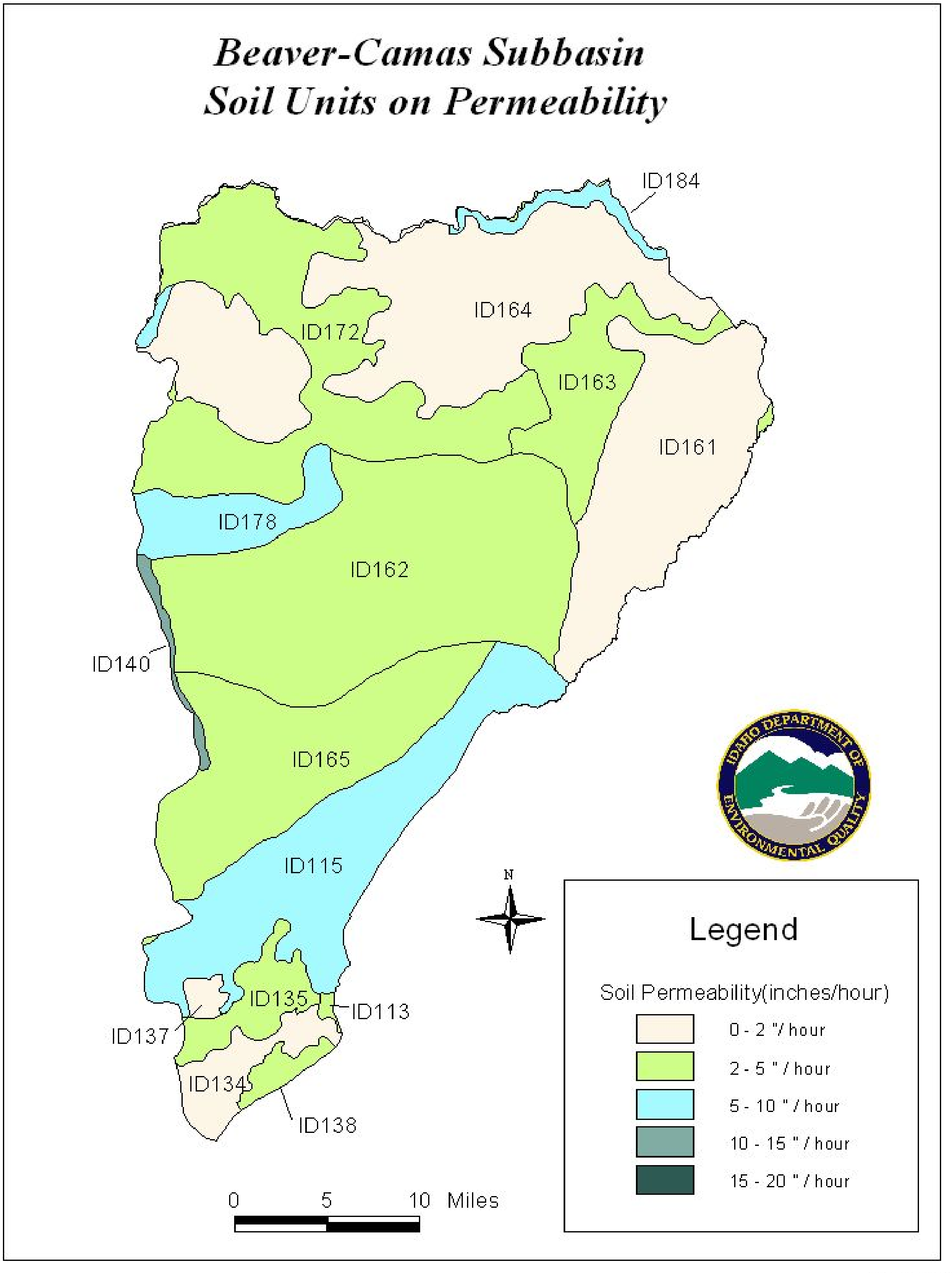


Figure 13. Soil Units on Soil Permeability.

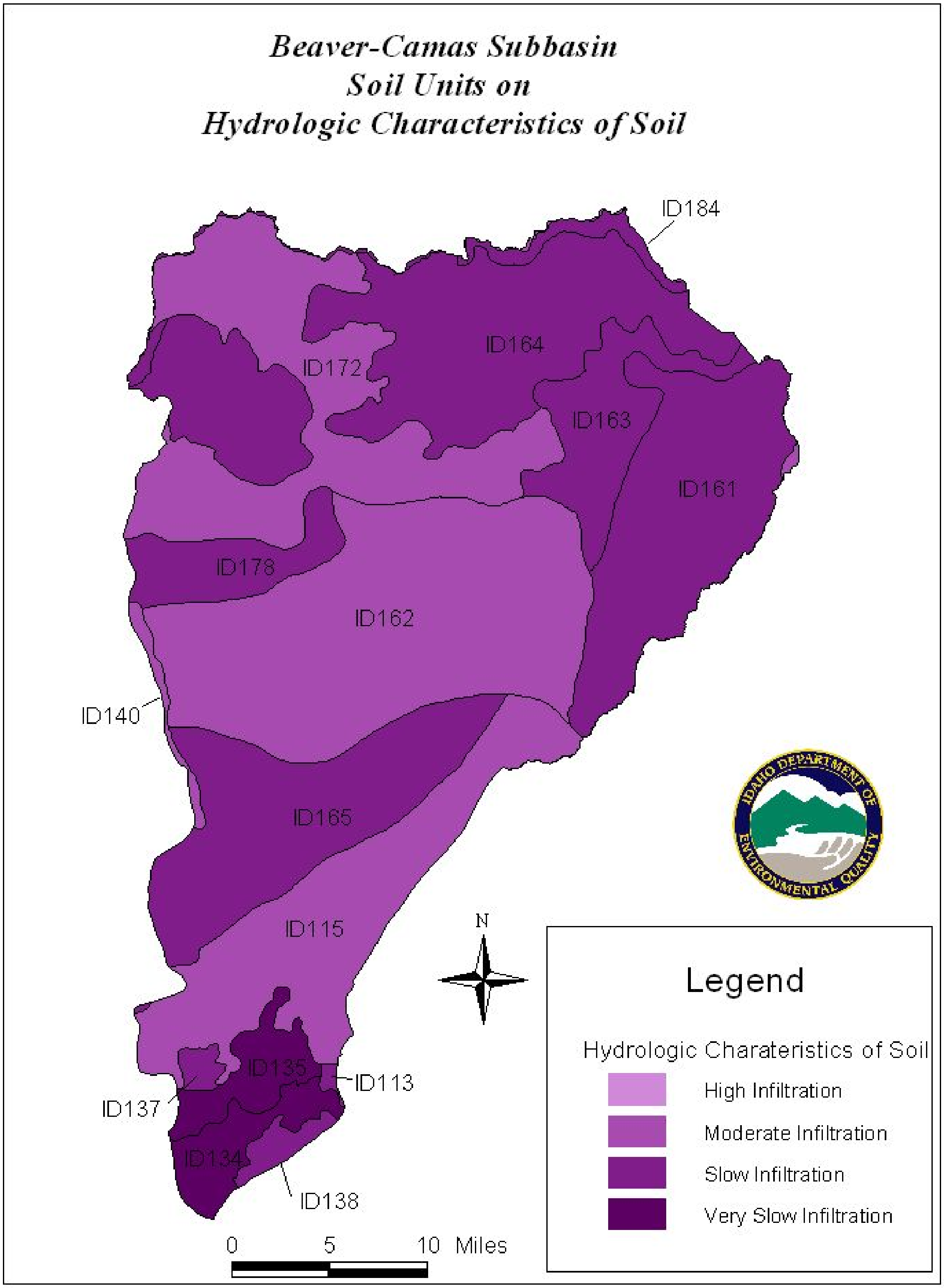


Figure 14. Soil Units on Hydrologic Characteristics of Soil.

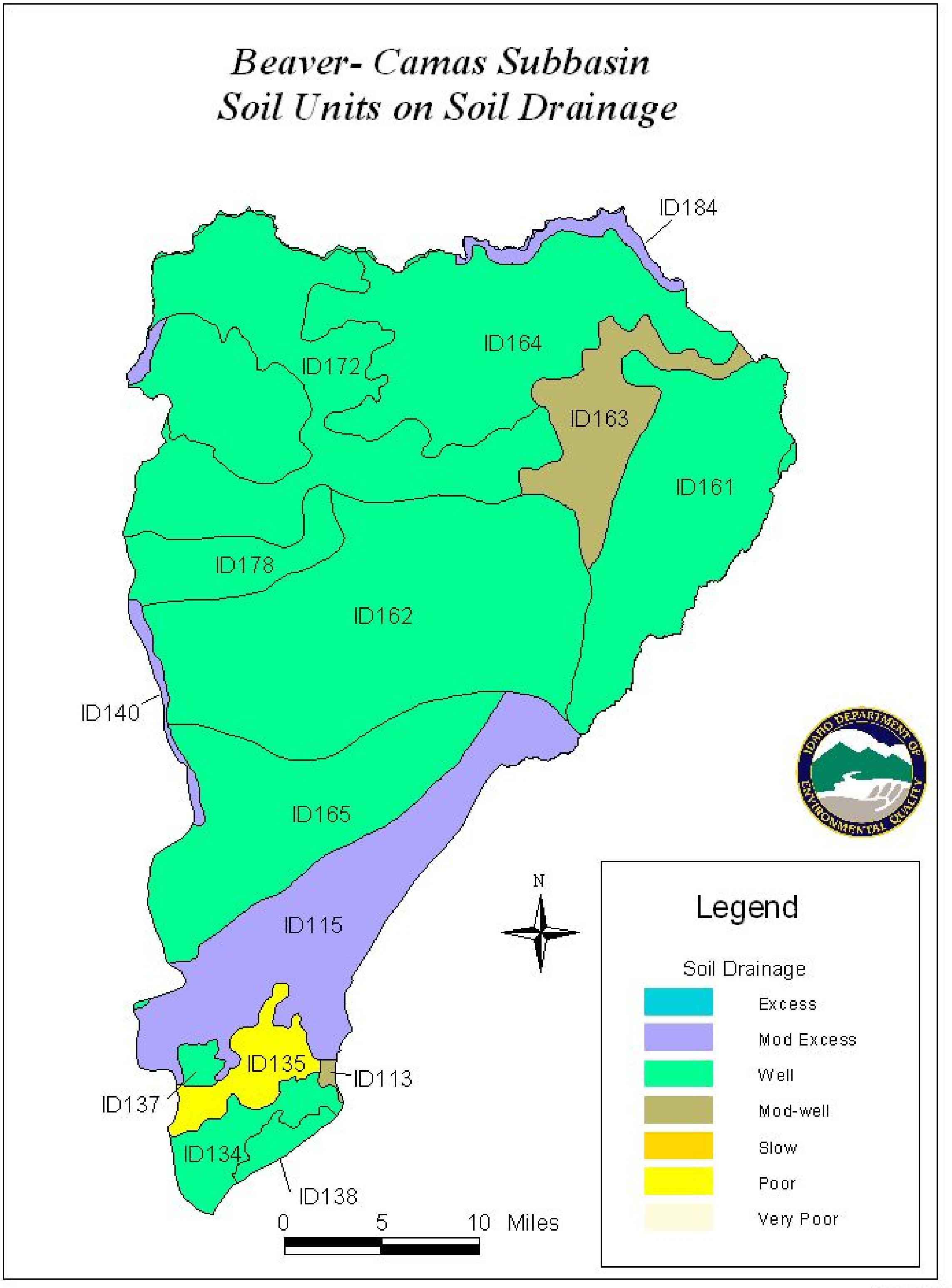


Figure 15. Soil Units on Soil Drainage.

Vegetation

Generally, overall vegetative cover in the watershed is that of rangeland vegetation, particularly in the central part of the watershed. The higher elevation, steeper sloped terrain in the basin is predominated by forestland. Irrigated crop production occurs in the southern portion of the watershed and pockets of dry land agriculture occur in the eastern portion of the subbasin. Windblown and lakebed deposits provide fertile agriculture land hence the incidence of crop production in this region of the subbasin. Figure 16 provides a description of landcover in the watershed.

Vegetation in the Beaver-Camas Watershed is very diverse, ranging from sagebrush and lava plants to lush wetlands and riparian corridors to forested mountains. This ecologically rich landscape of southeastern Idaho contributes to Idaho's biodiversity.

As a means for rare plant species conservation, the Bureau of Land Management (BLM) has created a *Rare Plant Field Guide* where plants listed in the guide are known or suspected to occur on lands administered by the BLM. Rare plants identified in the field guide as occurring in the Beaver-Camas Watershed are listed in Table 7.

Table 7. BLM identified rare plants in the Beaver-Camas Watershed.

Scientific Name	Common Name
Astragalus bisulcatus	Two-grooved milkvetch
Astragalus drummondi	Drummond's milkvetch

The Idaho Conservation Data Center (IDCDC), a division of NatureServe network, is a central repository for information Idaho's rare plant and animal species. The intent of IDCDC is to provide accurate, comprehensive, and timely information on Idaho's rare species so that appropriate land management decisions are made in the earliest stages of land management planning.

The IDCDC database is maintained and updated through ongoing biological analysis of rare, threatened, endangered, and special plant and animal communities. Data from those analyses are stored in the database and updated whenever additional information is available from agencies and institutions. (http://fishandgame.idaho.gov/tech/cdc/plants.home.cfm)

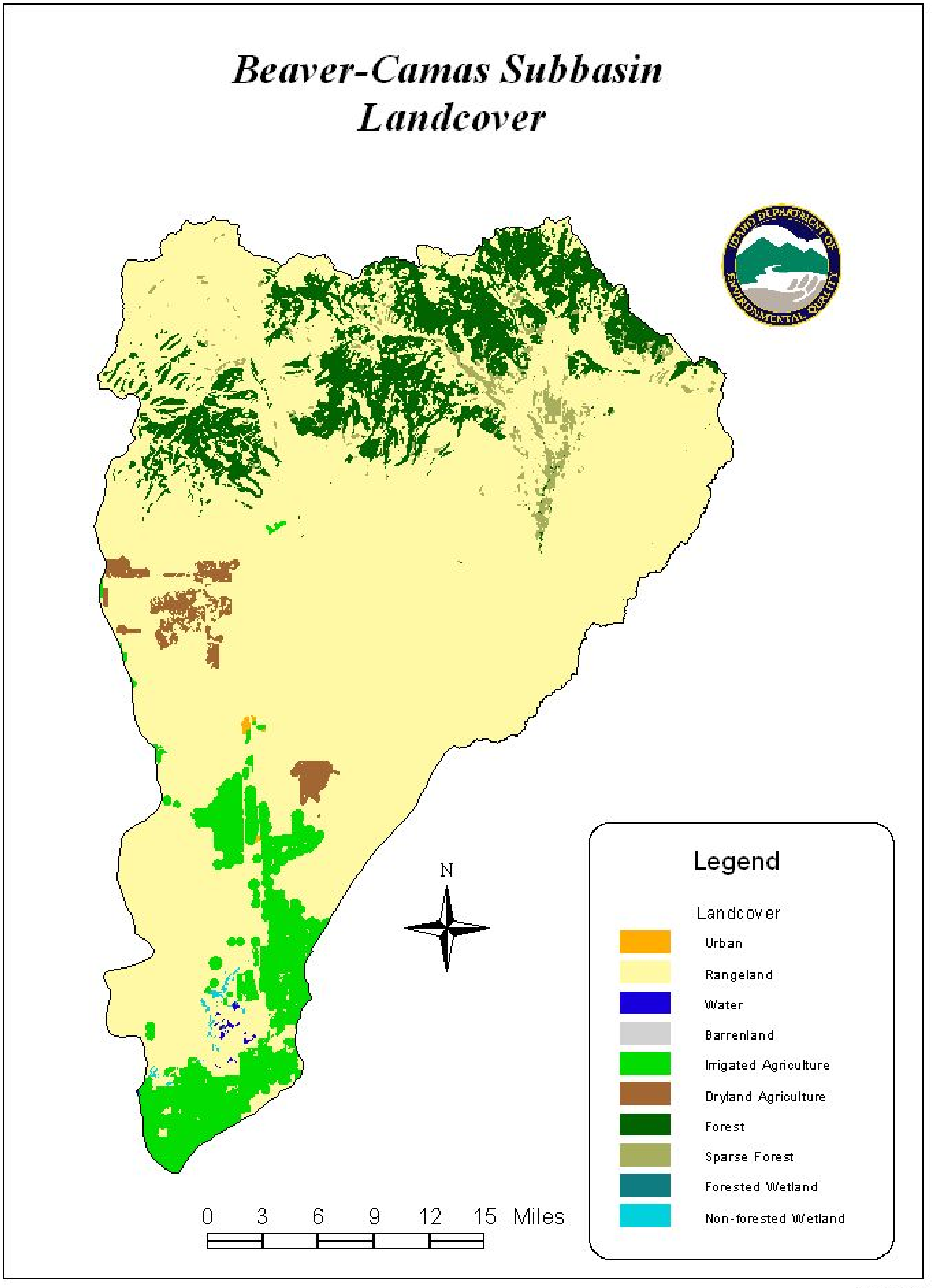


Figure 16. Beaver-Camas Subbasin Landcover.

A list of special status plants for Clark County, Idaho has been developed by the IDCDC. Identified special status plants are listed in Table 8 by scientific name (left column) and the associated common name (right column).

Table 8. CDC list of special status plants located in Clark County.

CLARK COUNTY	
AGOSERIS LACKSCHEWITZII	PINK AGOSERIS
ASTRAGALUS BISULCATUS VAR BISULCATUS	TWO-GROOVE MILKVETCH
ASTRAGALUS DIVERSIFOLIUS	MEADOW MILKVETCH
ASTRAGALUS DRUMMONDII	DRUMMOND'S MILKVETCH
ASTRAGALUS GILVIFLORUS	PLAINS MILKVETCH
BOUTELOUA GRACILIS	BLUE GRAMMA
CAMISSONIA PTEROSPERMA	WINGED-SEED EVENING PRIMROSE
CAREX PARRYANA SSP IDAHOA	IDAHO SEDGE
CHRYSOTHAMNUS PARRYI SSP MONTANUS	CENTENNIAL RABBITBRUSH
CUSCUTA DENTICULATA	SEPAL-TOOTH DODDER
DRABA INCERTA	YELLOWSTONE DRABA
EPILOBIUM PALUSTRE	SWAMP WILLOW-WEED
EPIPACTIS GIGANTEA	GIANT HELLEBORINE
KOBRESIA SIMPLICIUSCULA	SIMPLE KOBRESIA
LOMATOGONIUM ROTATUM	MARSH FELWORT
PIPTATHERUM MICRANTHUM	SMALL-FLOWERED RICEGRASS
PRIMULA ALCALINA	ALKALI PRIMROSE
SALIX CANDIDA	HOARY WILLOW
SALIX PSEUDOMONTICOLA	FALSE MOUNTAIN WILLOW
SCIRPUS ROLLANDII	ROLLAND BULRUSH
SILENE SCAPOSA VAR LOBATA	SCAPOSE SILENE
STIPA VIRIDULA	GREEN NEEDLEGRASS

Hydrography/Hydrology

Hydrologically, the Beaver-Camas Subbasin is a closed drainage, commonly referred to as a “sinks drainage.” The Beaver-Camas watershed is the easternmost drainage in a system that shows no connectivity to the Snake River. Surface water naturally infiltrates to the Snake River Plane Aquifer and a significant quantity of surface water is diverted for agricultural use.

Specifically, in the Beaver-Camas watershed, there are two main drainages that combine to form the subbasin: the Beaver Creek drainage and the Camas Creek drainage. Both of the drainages receive their flow in the northern mountainous regions in the upper watershed. Natural infiltration and irrigation limit the presence of water in the lower two-thirds of the subbasin.

The hydrology of the Beaver Creek drainage is principally spring runoff driven. There are several major tributaries that provide flow to Beaver Creek; Modoc Creek, Idaho Creek, Pleasant Valley Creek, Miners Creek, Stoddard Creek, and Dairy Creek. All of these waters drain into Beaver Creek above Spencer and they all are perennial streams. Few water diversions are above this point since the region is mountainous and unsuitable for crop production. Below Spencer, there are two main drainages, which are often intermittent, that flow to Beaver Creek. Those drainages are Rattlesnake Creek and Dry Creek. Water diversion structures are located in these two drainages, which contribute to reducing and/or eliminating perennial flow to Beaver Creek. Flow data from various USGS gauge stations (see section 2.3) provide a picture of the hydrologic characteristics in the Beaver Creek watershed. Water is sustained in Beaver Creek throughout the year in, above Spencer however, below Spencer, water naturally infiltrates into the porous basalt streambed and annual sustained flows are do not occur in Beaver Creek several miles downstream of Spencer.

The hydrologic characteristics of Camas Creek are even more complex and diverse that those of Beaver Creek. The upper eastern edge of the watershed is the source of flow to Camas Creek, like Beaver Creek, flows are principally spring runoff and precipitation driven.

From west to east, Crooked/Crab Creek, West Camas Creek, East Camas Creek, Warm Creek, Cottonwood Creek, Ching Creek, and Spring Creek all drain from the mountains, along the continental divide, to a complex of wetlands extending from Kilgore to Eighteenmile. There are several water diversion structures and canal systems utilized in this upper portion of the drainage with flows diverted for irrigated pastures in the valleys. Near Eighteenmile, below the wetlands, all of the streams converge to one point, this is considered the headwaters of Camas Creek. As shown by flow data in section 2.3, Camas Creek receives a very large volume of water from the upstream tributaries and flow is sustained in the creek year round to about T9N, R36E, Section 16 (N44.19270°, W-111.98284°), where land use changes from rangeland to irrigated agriculture and several major water diversion structures remove the surface water. The entire length of Camas Creek is a loosing reach through the porous basalt streambed.

Camas Creek, below Camas, will receive an annual spring flush, however continuous flows are not sustained above this point. Further downstream, just above the Camas Creek National Wildlife Headquarters, groundwater is pumped into a dry Camas Creek to return flows for irrigation. There is a complex system of groundwater wells that return flow to Camas Creek for irrigation. This system of wells, known as the “Owsley Wells,” and the water pumped by them are responsible for providing the water that sustains Mud Lake.

Mud Lake is located in the southern tip of the Beaver-Camas Subbasin and it is the hydrologic endpoint. There are no natural surface flows from Mud Lake to any other body of water.

The Cottonwood Creek Complex is located on the very central western edge of the subbasin. This is a system of ephemeral streams that have no surface connectivity to other waters.

Section 2.3 provides a more detailed analysis of flow regimes in the Beaver-Camas Subbasin.

Fisheries

There are several species of fish residing in the Beaver-Camas Subbasin. Representatives of the sucker family (Catostomidae), sculpin family (Cottidae), sunfish family (centrarchidae), pike family (Esicudae), minnow family (Cyprinidae), as well as the trout and salmon family (salmonidae) are known to occur. The Utah sucker (*Catostomus ardens*) is the only member of the sucker family reported in the basin. Minnows reported in the subbasin include the longnose dace (*Rhinichthys cataractae*), speckled dace (*Rhinichthys osculus*), redside shiner (*Richardsonius balteatus*), and Utah chub (*Gila atraria*). Species of salmonidae reported in the subbasin include cutthroat trout (*Oncorhynchus clarki*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*) and rainbow x cutthroat hybrids. The largemouth bass (*Micropterus salmoides*), bluegill (*lepomis macrochirus*), and yellow perch (*Perca flavescens*) are members of the sunfish family and they are only located in Mud Lake at the base of the watershed. Like the members of the sunfish family, the tiger muskie (Esox lucius x Esox masquinongy), a member of the pike family has been introduced to Mud Lake for its fishery value. (Simpson and Wallace 1982, IDFG 1990)

The fishery in the Beaver-Camas Creek drainage, is dominated by brook trout, with limited trout survival below the Red Road on Camas Creek due to unfavorable water conditions. The Camas Creek stream is characterized by lava canyons with permeable streambeds and limited riparian vegetation for shading. Limited spawning habitat from irrigation withdrawals and over grazing in the lower sections of the watershed Creek limit trout survival and reproduction. (IDFG 1990)

The Yellowstone cutthroat trout (YCT) is the native species and the species of greatest concern in the subbasin. The historic range of the Yellowstone cutthroat trout includes the Yellowstone River drainage in Montana and Wyoming and portions of the Snake River Drainage in Wyoming, Idaho, Nevada, and Utah. It is thought that the Yellowstone cutthroat trout is currently located in approximately 10% of its original stream range. Several factors, such as habitat destruction, exploitation, and introductions of non-native fish have all contributed to the decline in YCT. (IDFG 2002)

The Yellowstone cutthroat is considered a state sensitive species in Idaho and is carefully managed by the Idaho Department of Fish and Game (IDFG). In 1998 it was petitioned to become a threatened species, but after review in February 2001, the USFWS declined the petition to list the Yellowstone cutthroat under the Endangered Species Act (ESA). In December 2004, a federal judge ruled that the USFWS illegally rejected the petition and subsequently ordered the USFWS to reconsider the request to grant federal ESA protection to the YCT.

Beaver

The beaver (*Castor canadensis*) is an important species in the development and continued sustenance of healthy stream and riparian systems. Beavers play an important role in maintaining stable channels by preserving riparian vegetation, reducing streambank erosion, storing sediment, raising the water table, and storing water for late season release. Beaver dams are typically constructed in willow dominated, medium to low gradient, meandering, valley bottom streams (Rosgen C or B type Channels). These channels evolved over time as beaver dams trapped fine sediments that were stabilized by willows. When vegetation and beaver are removed from the system (due to trapping and/or browsing competition) dams are no longer maintained and hence are more likely to fail and release stored sediment. The increase of upstream sediment supply from grazing, cultivated agriculture, roads, urban development and timber harvest can accelerate dam failure resulting in rapid sediment release. When changes occur in the riparian plant community, the positive benefits of beavers are lost and the stream is susceptible to incising and the productive riparian areas convert to drier upland sagebrush regions as a result of lowering the water table (Caribou-Targhee 2000).

Several streams in the Beaver-Camas Subbasin support active beaver complexes. Beaver dams have the potential to increase stream temperatures by reducing stream flows and holding water back in stagnant pools where thermal loading to the stream is higher.

Subwatershed Characteristics

The Beaver-Camas Subbasin is divided into six fifth field subwatersheds. The Upper Beaver Creek and Spring Creek subwatersheds have the highest drainage densities supplying the vast majority of surface water to the lower sections of the watershed. The Upper and Lower Beaver Creek subwatersheds contain the Beaver Creek drainage system. The Spring Creek, Camas Creek, and Camas Creek National Wildlife Refuge contain the Camas Creek drainage. The Cottonwood Creek subwatershed is entirely closed system of streams located on the western edge of the subbasin. Figure 17 provides an illustration of the subwatersheds in the subbasin.

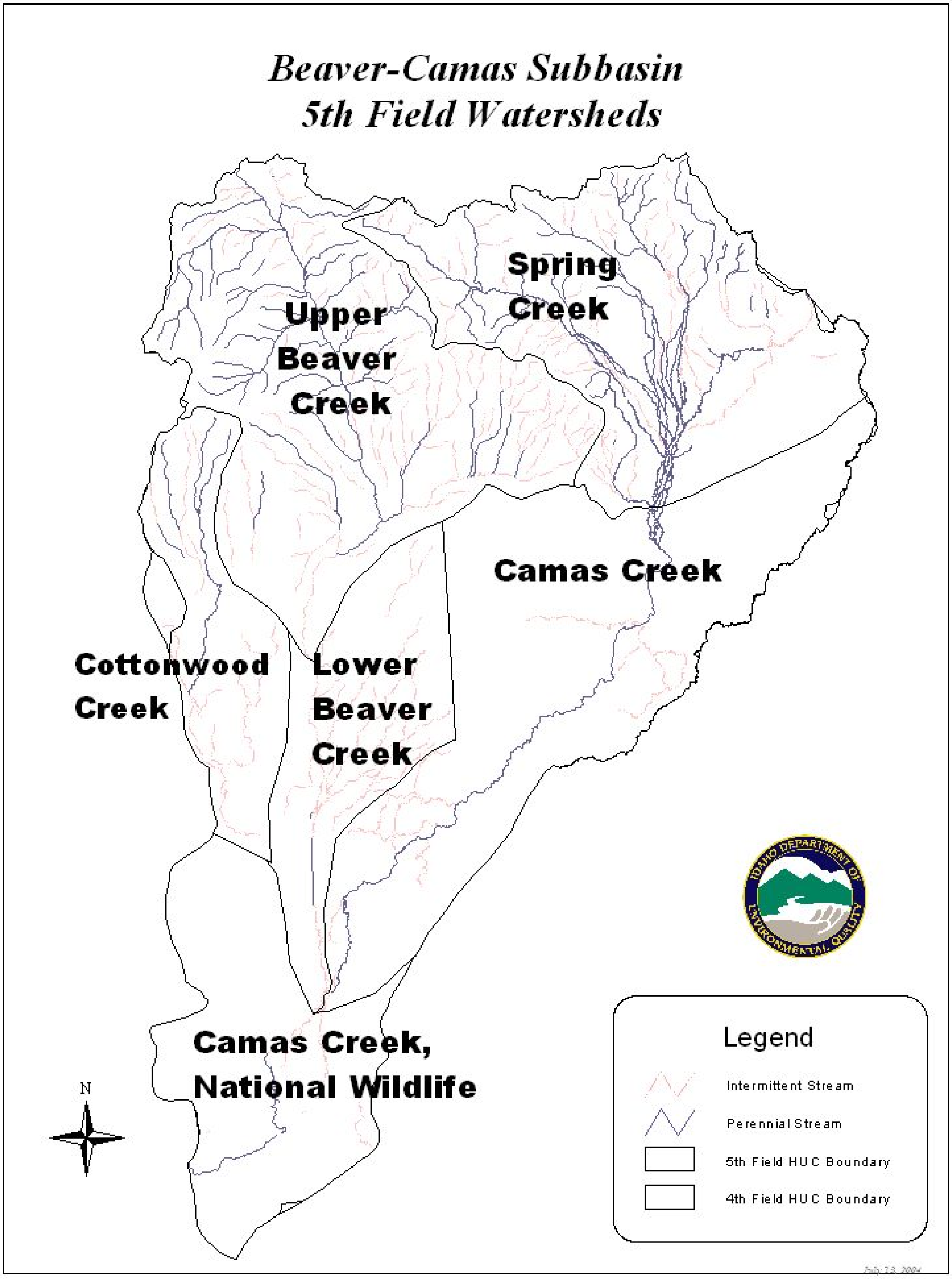
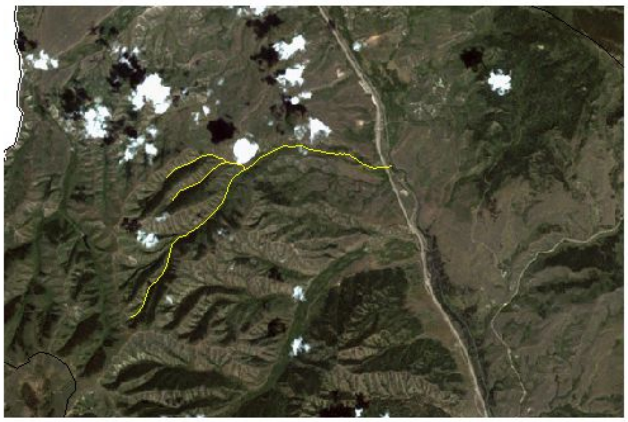


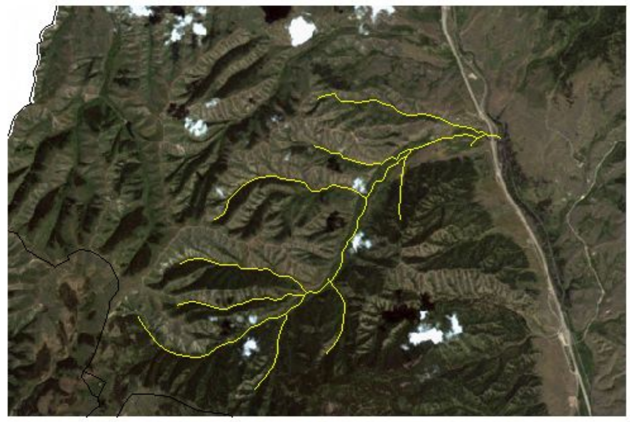
Figure 17. Beaver-Camas Subbasin Subwatershed Boundaries.

Upper Beaver Creek Subwatershed

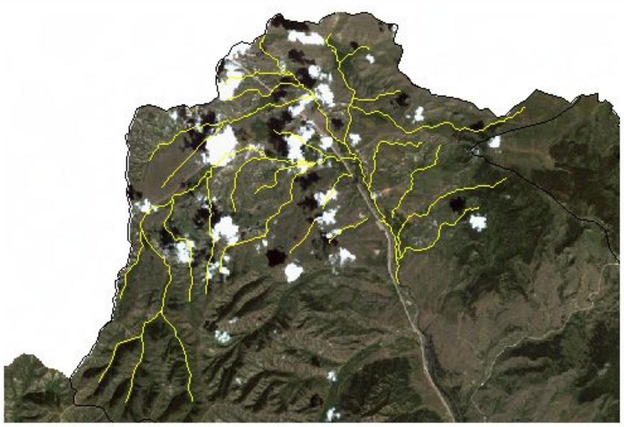
The Beaver Creek subwatershed (158,056 acres) is positioned in the upper west half of the subbasin; the Continental Divide is the upper boundary. The lower subwatershed boundary is located below the Dry Creek confluence. All of the perennial streams in the Beaver Creek drainage are located in this subwatershed. Perennial streams in this watershed include Modoc Creek, Idaho Creek, Miners Creek, Pleasant Valley Creek, Dairy Creek, and Stoddard Creek. The Rattlesnake and Dry Creek drainages often do not show connectivity with Beaver Creek all year long. 303(d) listed (red line) portions of Beaver Creek are located in this watershed. Figure 18 provides a satellite image of the drainages in the Upper Beaver Creek subwatershed.



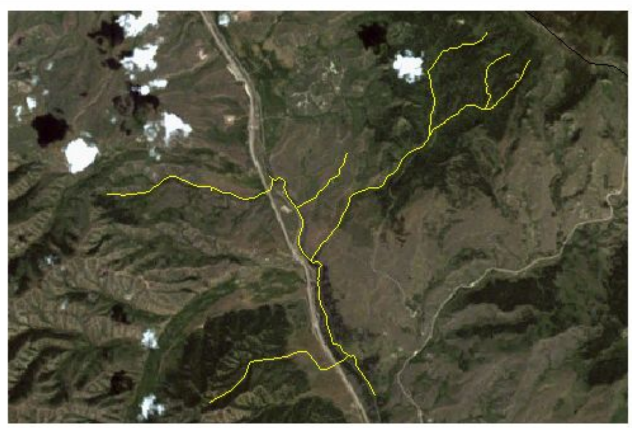
Idaho Creek ID17040205SK22
Source to mouth



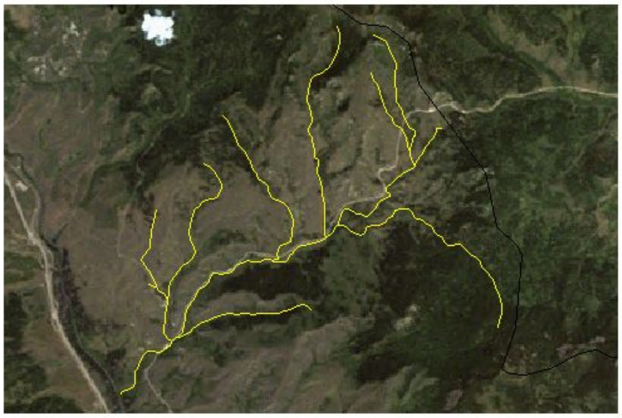
Pleasant Valley Creek ID17040205SK23
Source to Mouth



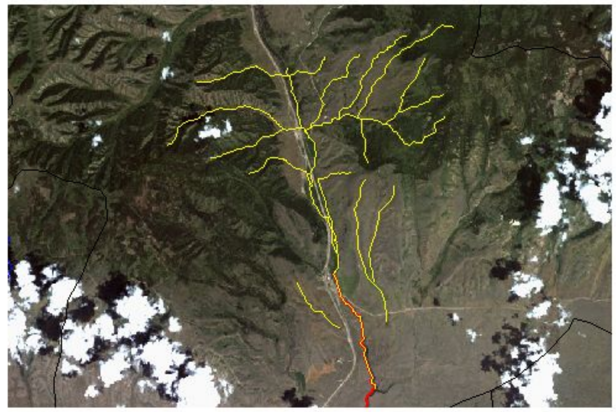
Beaver Creek ID17040205SK21
Source to Idaho Creek



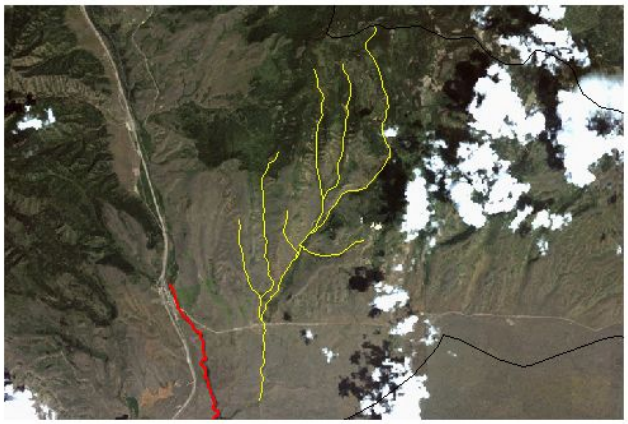
Beaver Creek ID17040205SK20
Idaho Creek to Miners Creek



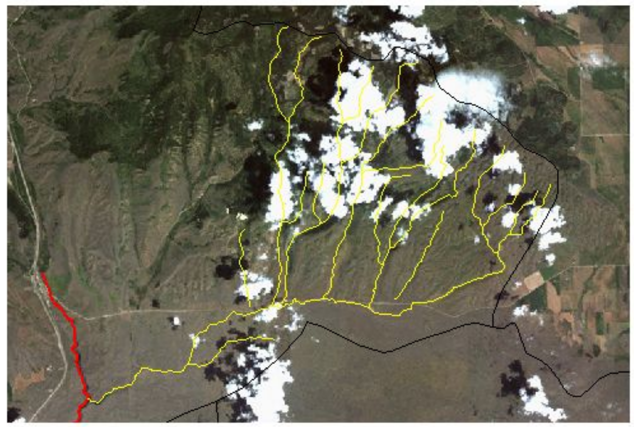
Miners Creek ID17040205SK19
Source to Mouth



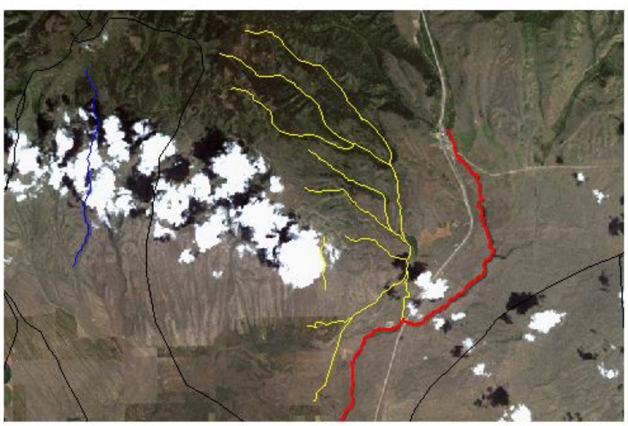
Beaver Creek ID17040205SK18
Miners Creek to Rattlesnake Creek



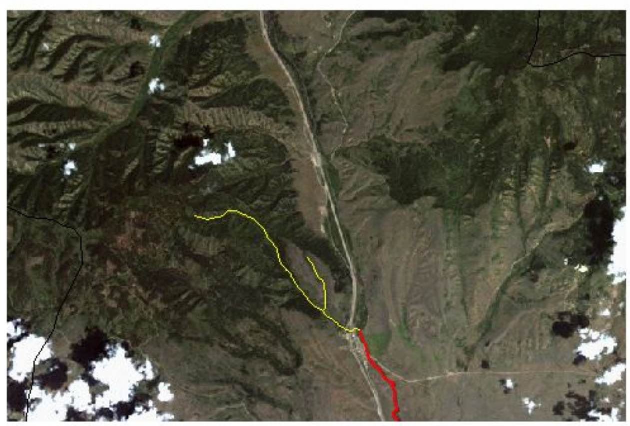
Threemile Creek ID17040205SK17
Source to Mouth



Rattlesnake Creek ID17040205SK16
Source to Mouth



Dry Creek ID17040205SK25
Source to Mouth



Huntley Canyon Creek ID17040205SK24
Source to Mouth

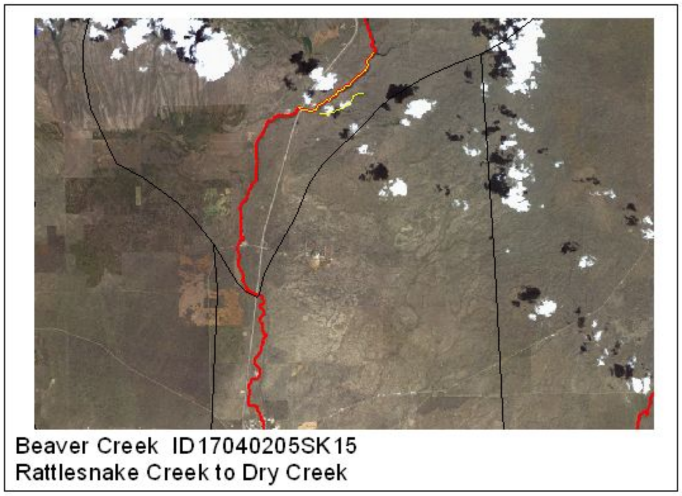


Figure 18. Drainages in the Upper Beaver Creek Subwatershed.

Lower Beaver Creek Subwatershed

The Lower Beaver Creek subwatershed (61,743 acres) is downstream of the Upper Beaver Creek subwatershed. It contains the section of Beaver Creek from the Dry Creek confluence to the mouth. The only tributaries feeding Beaver Creek are ephemeral and Beaver Creek is intermittent through this subwatershed. Approximately 3.5 miles south of Dubois, Beaver Creek is converted to a canal and all irrigated agriculture in this subwatershed is sustained by groundwater. This subwatershed contains some of the 303(d) listed (red line) portion of Beaver Creek.

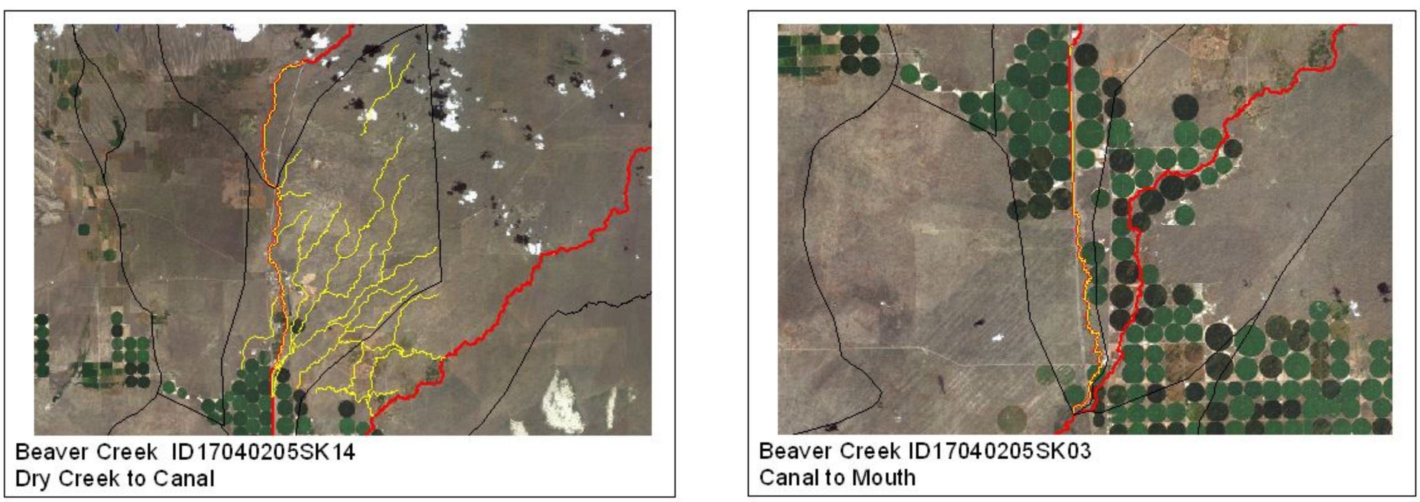
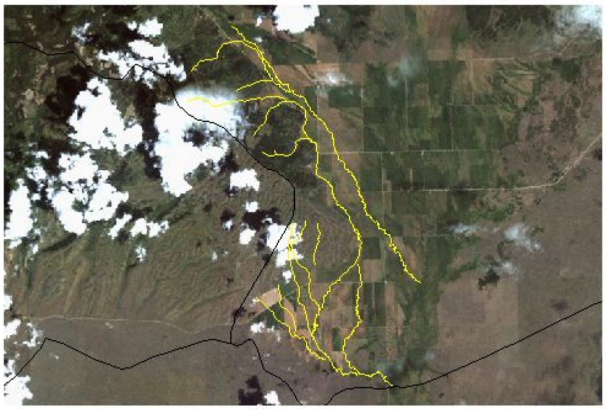


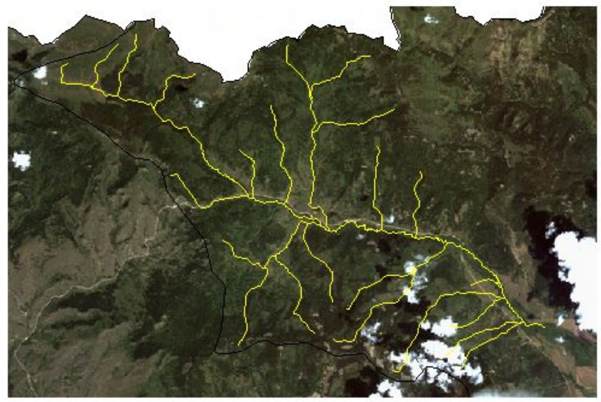
Figure 19. Drainages in the Lower Beaver Creek Subwatershed.

Spring Creek Subwatershed

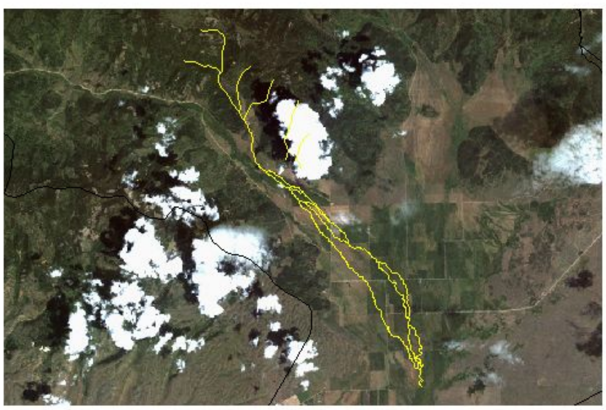
This subwatershed is approximately 132, 958 acres and it is located in the northeastern section the subbasin. This Spring Creek subwatershed is bounded in the north by the Continental Divide with the lower end at the headwaters of Camas Creek near Eighteenmile. This subwatershed provides all of the drainage for Camas Creek. Perennial streams in this subwatershed are Crooked/Crab Creek, West Camas Creek, East Camas Creek, Warm Creek, Cottonwood Creek, Ching Creek, and Spring Creek. No 303(d) listed streams (red line) are located in this subwatershed.



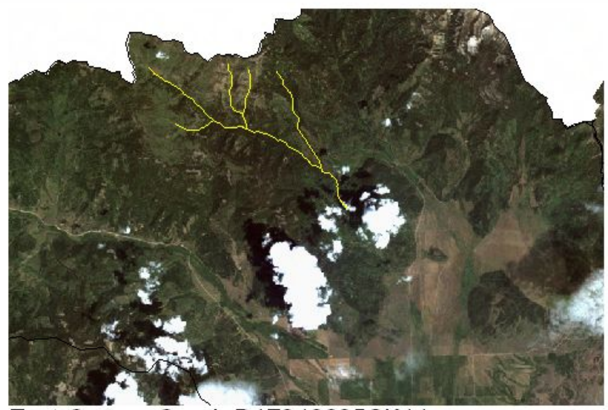
Crooked/Crab Creek D17040205SK08
Source to Mouth



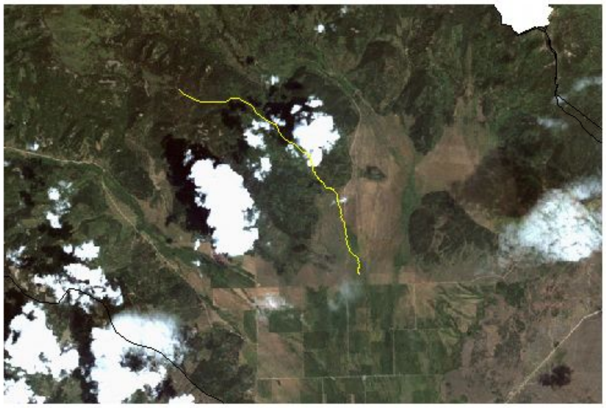
West Camas Creek ID17040205SK13
Source to Forest boundary



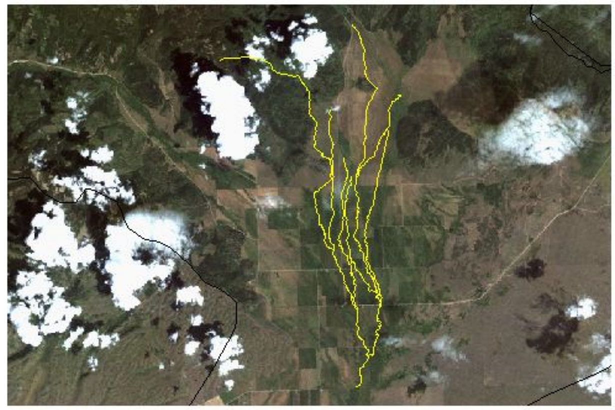
West Camas Creek ID17040205SK12
Forest boundary to Camas Creek



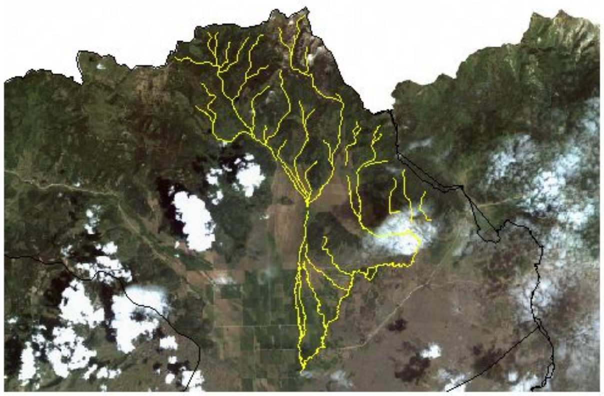
East Camas Creek D17040205SK11
Source to Larkspur Creek



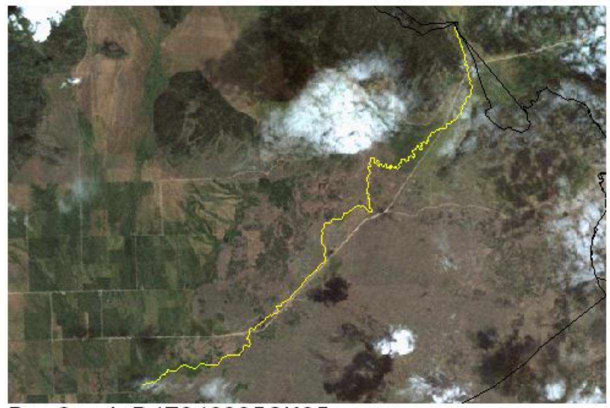
East Camas Creek ID17040205SK10
From and including Larkspur Creek to T13N, R39E, Sec 20



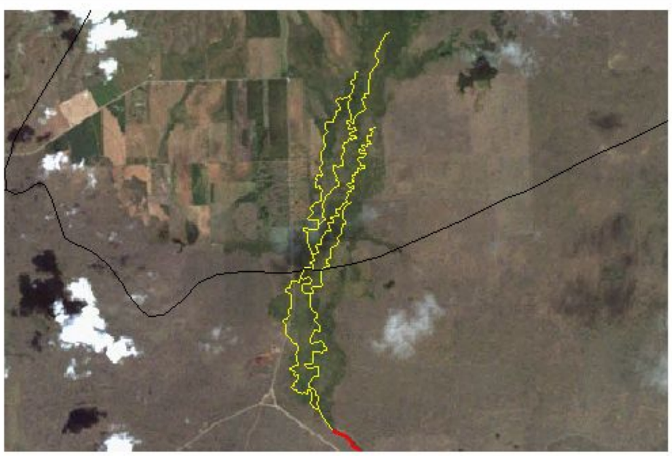
Warm Creek D17040205SK09
Cottonwood Creek to mouth and East Camas Creek



Ching Creek D17040205SK06
Source to Mouth



Dry Creek D17040205SK05
Source to Mouth



Camas Creek D17040205SK07
Confluence of W and E Camas Creeks to Spring Creek

Figure 20. Drainages in the Spring Creek Subwatershed.

Camas Creek Subwatershed

This subwatershed (15,5471 acres) is located below the Spring Creek subwatershed and drains to the confluence of Beaver Creek. Camas Creek is the only water in this subwatershed and this section of Camas Creek is 303(d) listed (red line) for flow alteration, habitat alteration, sediment, nutrients, and temperature. Irrigation systems are placed all along Camas Creek from Spring Creek to Beaver Creek. Irrigation removal and natural infiltration limit perennial surface water flows in the lower section of this subwatershed . As depicted in Figure 21, in the lower section of this particular reach, the land use changes from rangeland to irrigated farmland.

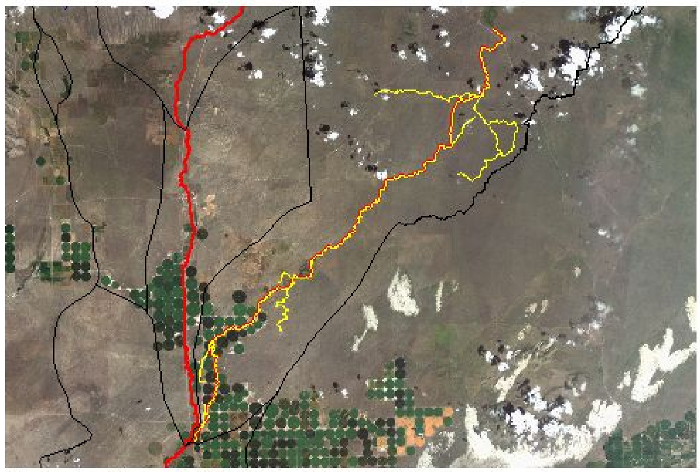


Figure 21. Camas Creek Subwatershed.

Camas Creek National Refuge Subwatershed

This subwatershed (81,206 acres) is bounded by the Beaver Creek confluence to Mud Lake, and contains the Camas Creek National Refuge. Camas Creek is naturally devoid of flow through the entire subwatershed, however, a complex irrigation system where groundwater is pumped into Camas Creek supplies irrigated agriculture in the area. Groundwater flow for irrigation eventually reaches Mud Lake, which is the endpoint for all drainage in the subbasin.

The section of Camas Creek in this watershed is 303(d) listed for flow alteration, sediment, and nutrients.

Camas National Wildlife Refuge

The Camas National Wildlife Refuge was established in 1937, with the intent to provide habitat for nesting waterfowl and to provide resting and feeding habitat for spring and fall migrating ducks, geese, and other waterfowl. The wildlife refuge is located in the Beaver-Camas Subbasin, 36 miles north of Idaho Falls at an elevation of about 4800 feet.

Camas Creek flows for eight miles through the length of the refuge and provides water to the many lakes and ponds located within the refuge boundaries. During the dry summer months, several wells sustain the lakes and ponds continuing to provide suitable habitat year round.

Mud Lake

Mud Lake, authorized by the Flood Control Act of 1950, was formed by a 10-mile-long embankment constructed years ago by local farmers. The embankment confines the lake and makes it possible to farm the surrounding lands and provide water elevation so that irrigation canals could deliver water to farms.

Mud Lake is a designated state Wildlife Management Area (WMA), established primarily to preserve and improve nesting habitat for waterfowl. The lake also provides a recreational fishery.

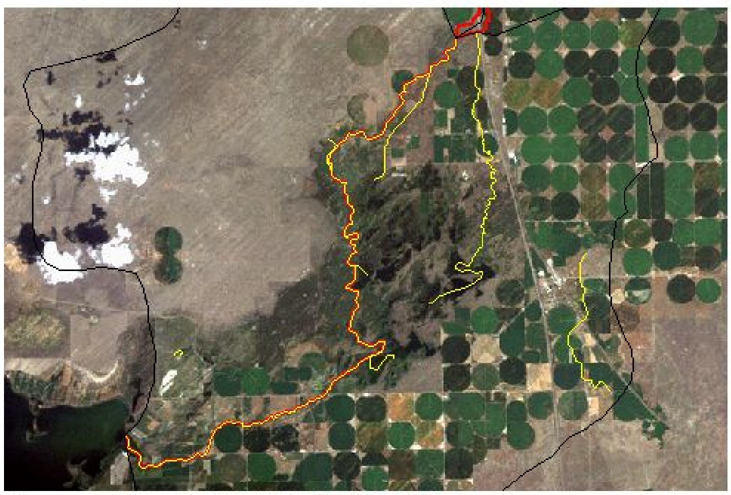


Figure 22. Camas Creek National Refuge Subwatershed.

Cottonwood Creek

The Cottonwood Creek subwatershed (49,184 acres) is located on the western edge of the subbasin. This subwatershed contains several ephemeral streams: Cow Creek, Patelzick Creek, and the Cotton Wood Creek complex. This system is entirely closed, showing no connectivity to other surface waters. Cow Creek is the listed stream in this subwatershed.

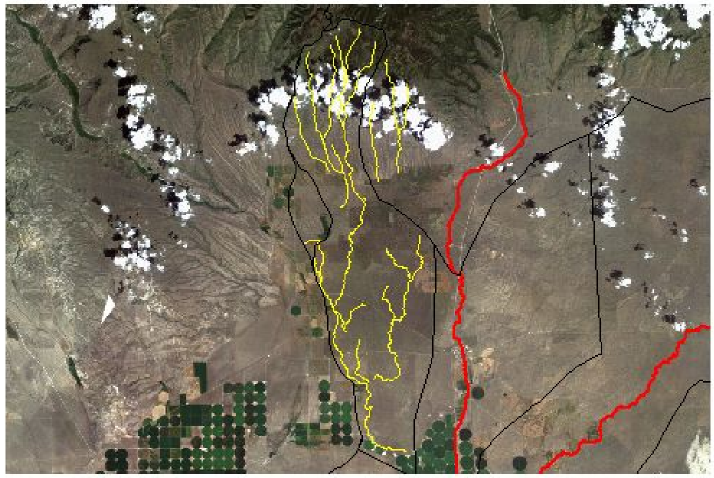

Cottonwood Creek Complex ID17040205SK26

Figure 23. Cottonwood Creek Subwatershed.

Stream Characteristics

Geomorphic characteristics of the streams in the Beaver Creek Subbasin vary considerably. Appendix A contains a summary of the subbasin's stream characteristics collected by the DEQ Beneficial Use Reconnaissance Program (BURP). These data provide a detailed description of several stream characteristics.

Geomorphic characterization of the steam channels was achieved utilizing the Rosgen Stream Classification System, Level 1 for stream types. Rosgen type A streams are entrenched, high energy, steep gradient streams with cascades and step/pool morphology. Rosgen type B streams are moderate gradient, with riffles. Rosgen type C streams are low gradient, slightly entrenched, meandering streams with point bar development, riffle/pool morphology and a well-defined floodplain. Rosgen type D streams occur in broad valleys and are braided streams with point bar formations. Rosgen E type streams are very low gradient, found in broad valleys, and highly sinuous. Rosgen F type streams are low gradient, entrenched meandering streams with riffle/pool formations. Rosgen G type streams are moderate gradient, entrenched streams with step/pool morphology. (Rosgen 1996)

Stream order is a hierarchical system for categorizing streams based on their degree of branching. For example, a first order stream is unbranched, a second order stream is a combination of two first order streams and, two second order streams make a third order stream, etc. Stream order is determined using a 1:100,000-scale map.

Substrate measurements are collected via a modified Wolman Pebble Count. The width/depth ratio is the ratio of the bankfull surface to the average depth of the bankfull channel. This measurement is essential to comprehending the distribution of available energy within a channel and the capability of discharges within the channel to transport sediment. Width/depth ratios are beneficial in determining channel stability. Sinuosity is "the ratio of channel length between two points in a channel to the strait line distance between the same two points".

Figures 24-29 show the stream and BURP site locations by subwatershed.

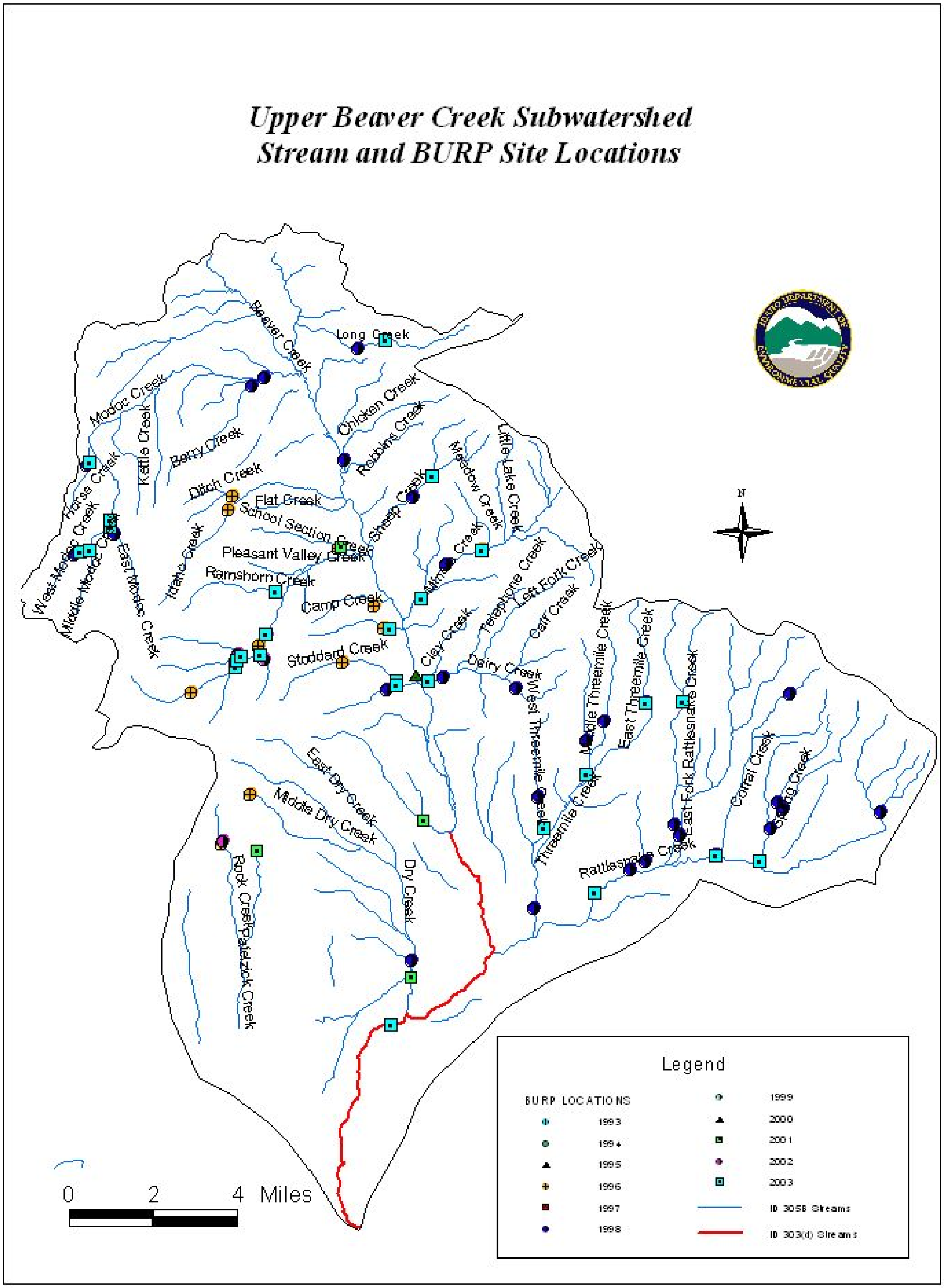


Figure 24. Stream and BURP Site Locations in the Upper Beaver Creek Subwatershed.

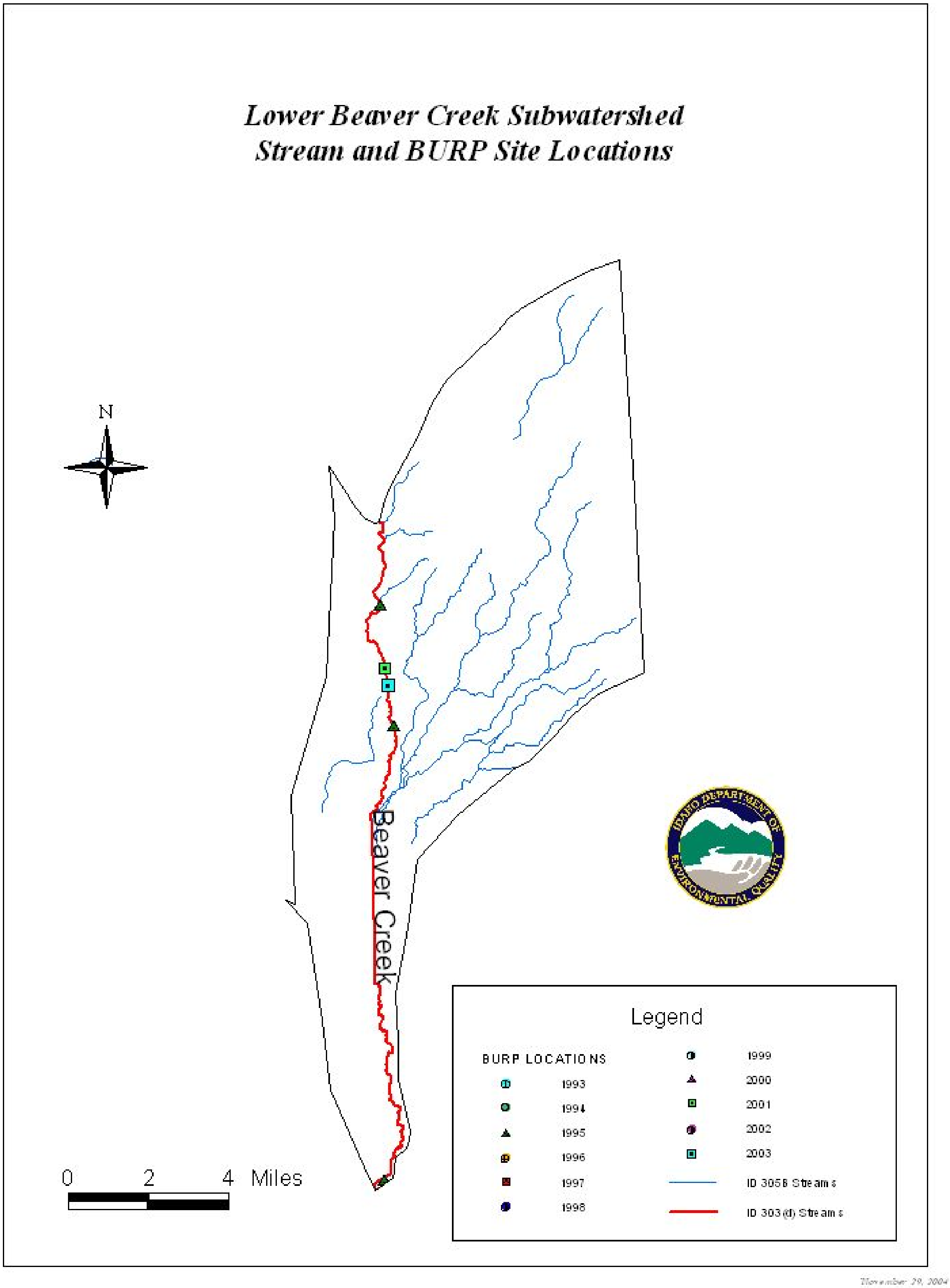


Figure 25. Stream and BURP Site Locations in the Lower Beaver Creek Subwatershed.

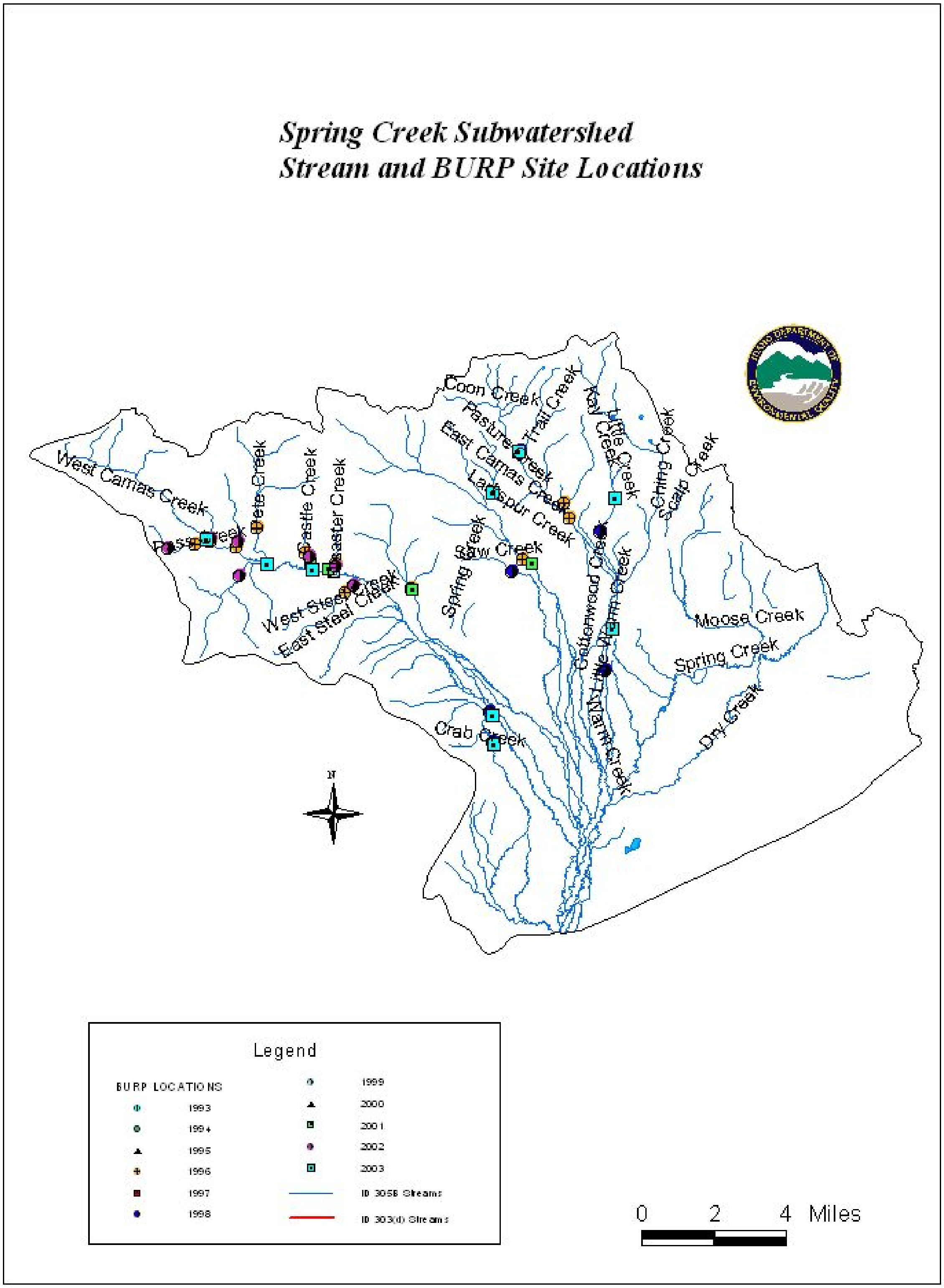


Figure 26. Stream and BURP Site Locations in the Spring Creek Subwatershed.

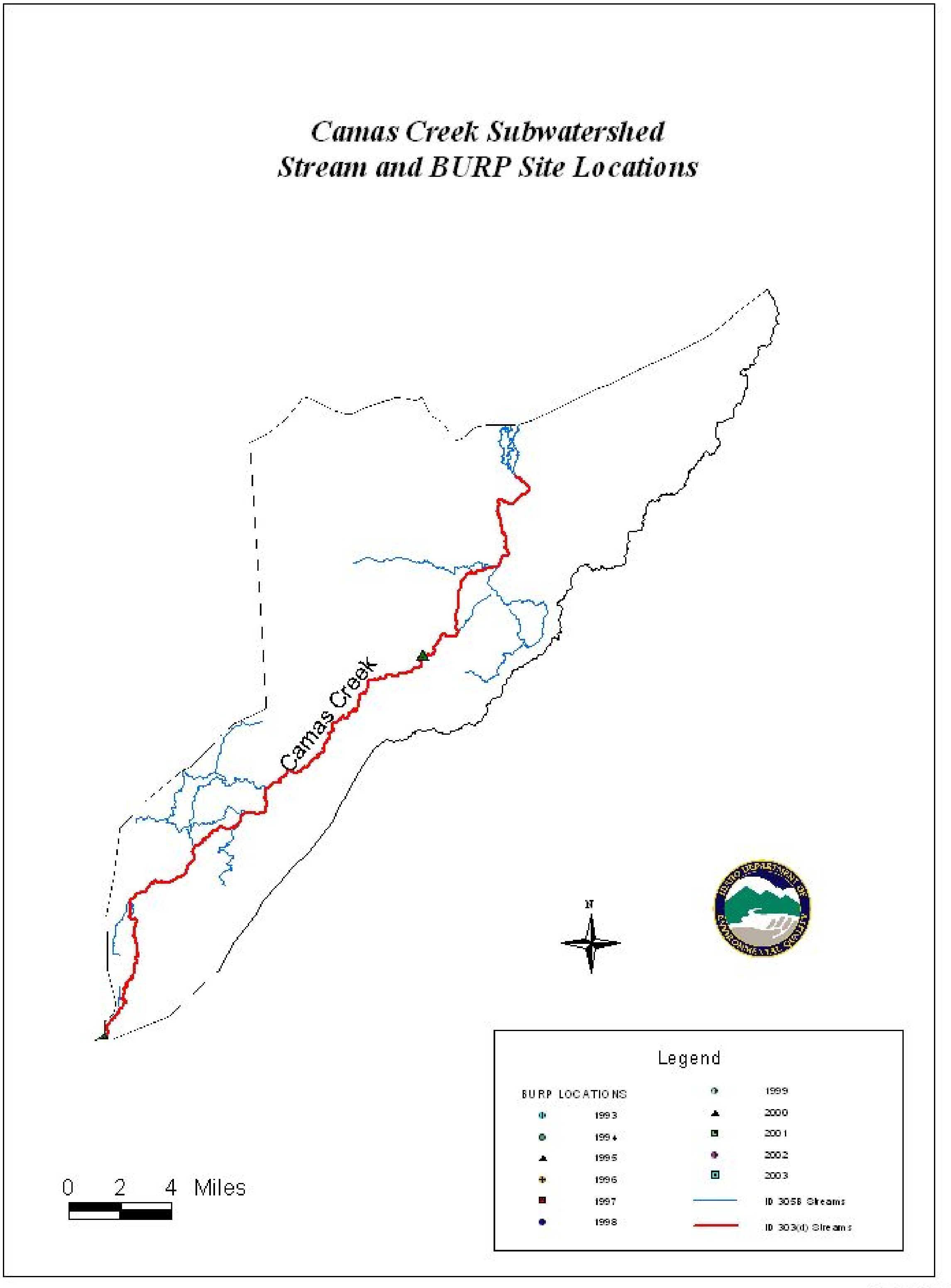


Figure 27. Stream and BURP Site Locations in the Camas Creek Subwatershed.

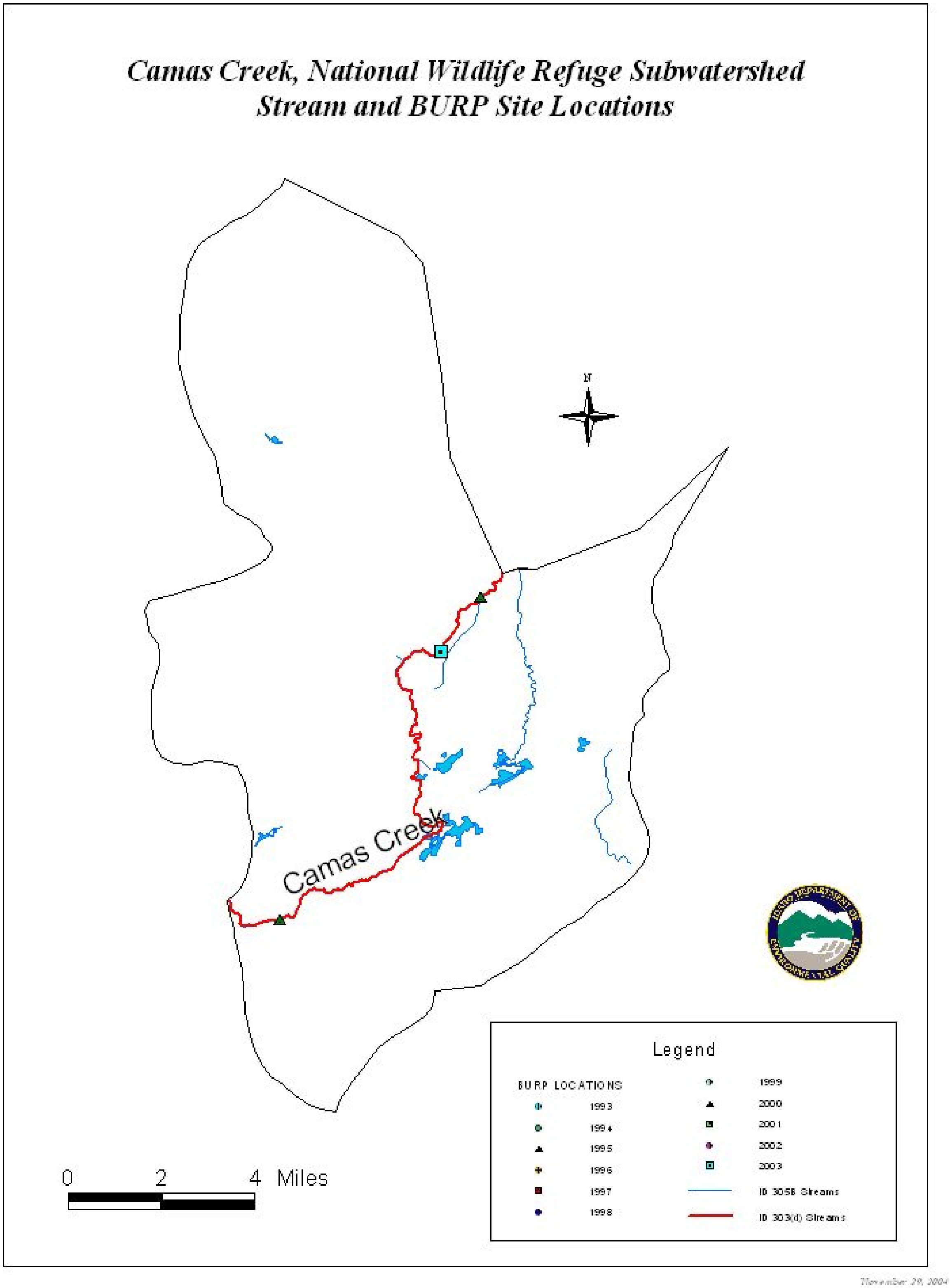


Figure 28. Stream and BURP Site Locations in the Camas Creek, National Wildlife Subwatershed.

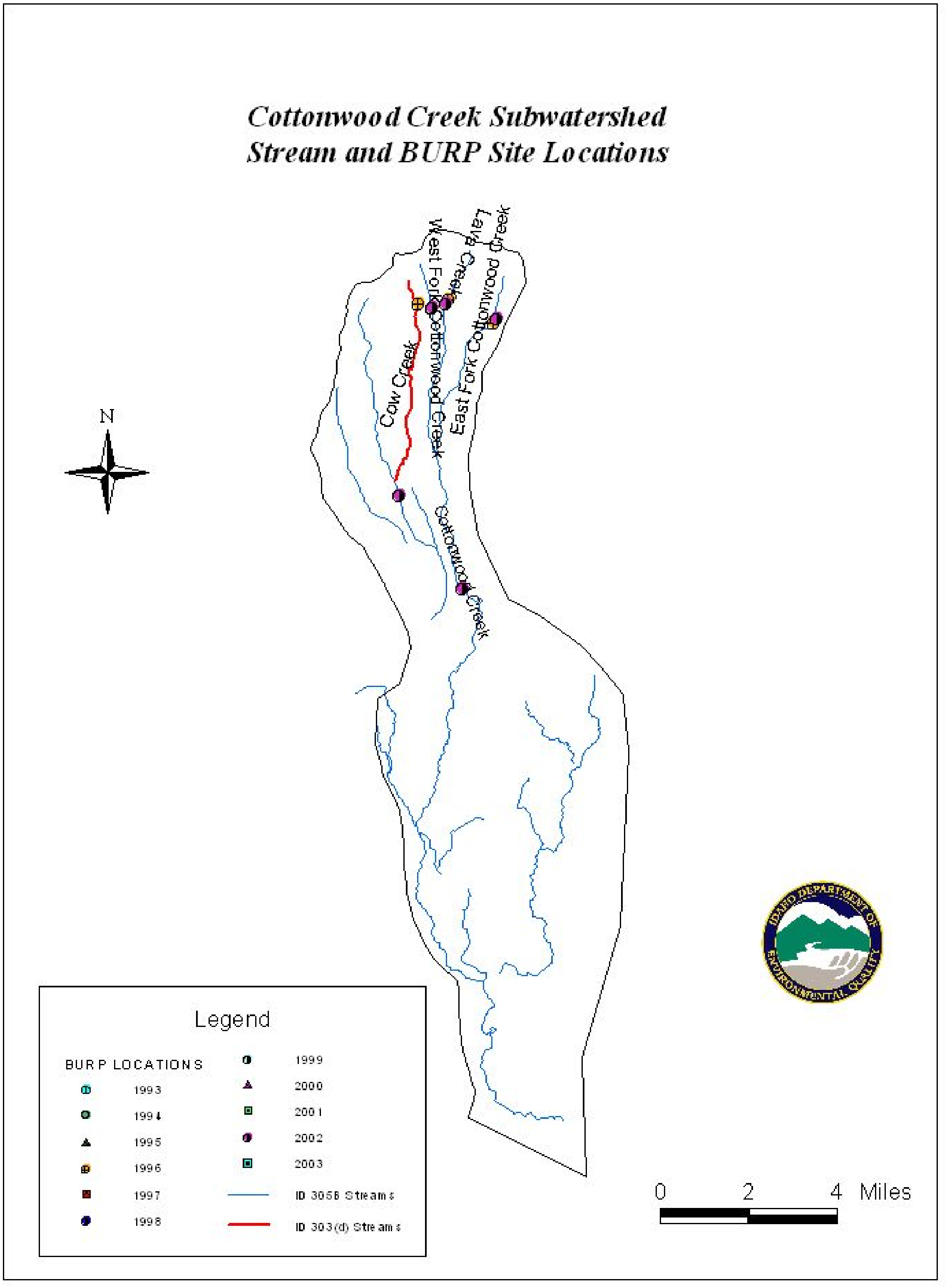


Figure 29. Stream and BURP Site Locations in the Cottonwood Creek Subwatershed.

1.3 Cultural Characteristics

The Beaver-Camas subbasin is a sparsely populated area with very few commercial activities. The main source of income in the area is agricultural related; the higher elevation regions of the watershed are reserved for rangeland and the lower sections of the watershed are utilized for irrigated crop production.

Landuse

Land use in the subbasin is primarily agriculture (Table 9 and Figure 30), with the majority of the watershed utilized for rangeland (64%). Forest lands are located in the northern, high elevation, steep terrained areas of the subbasin, approximately 21% of total land use.

The majority of the irrigated land (gravity flow and sprinkler) is located in the southern portion of the watershed where soils and topography are more amenable to crop production. A rich riparian community exists around Mud Lake; this is the smallest portion of land use at 1%.

Table 9. Land use statistics for the Beaver-Camas Subbasin.

Land use	Acres	% of Total
Forest	136059	21%
Rangeland	411842	64%
Irrigated-Sprinkler	38950	6%
Irrigated-Gravity Flow	48388	8%
Riparian	7849	1%
Total	**643088**	**100%**

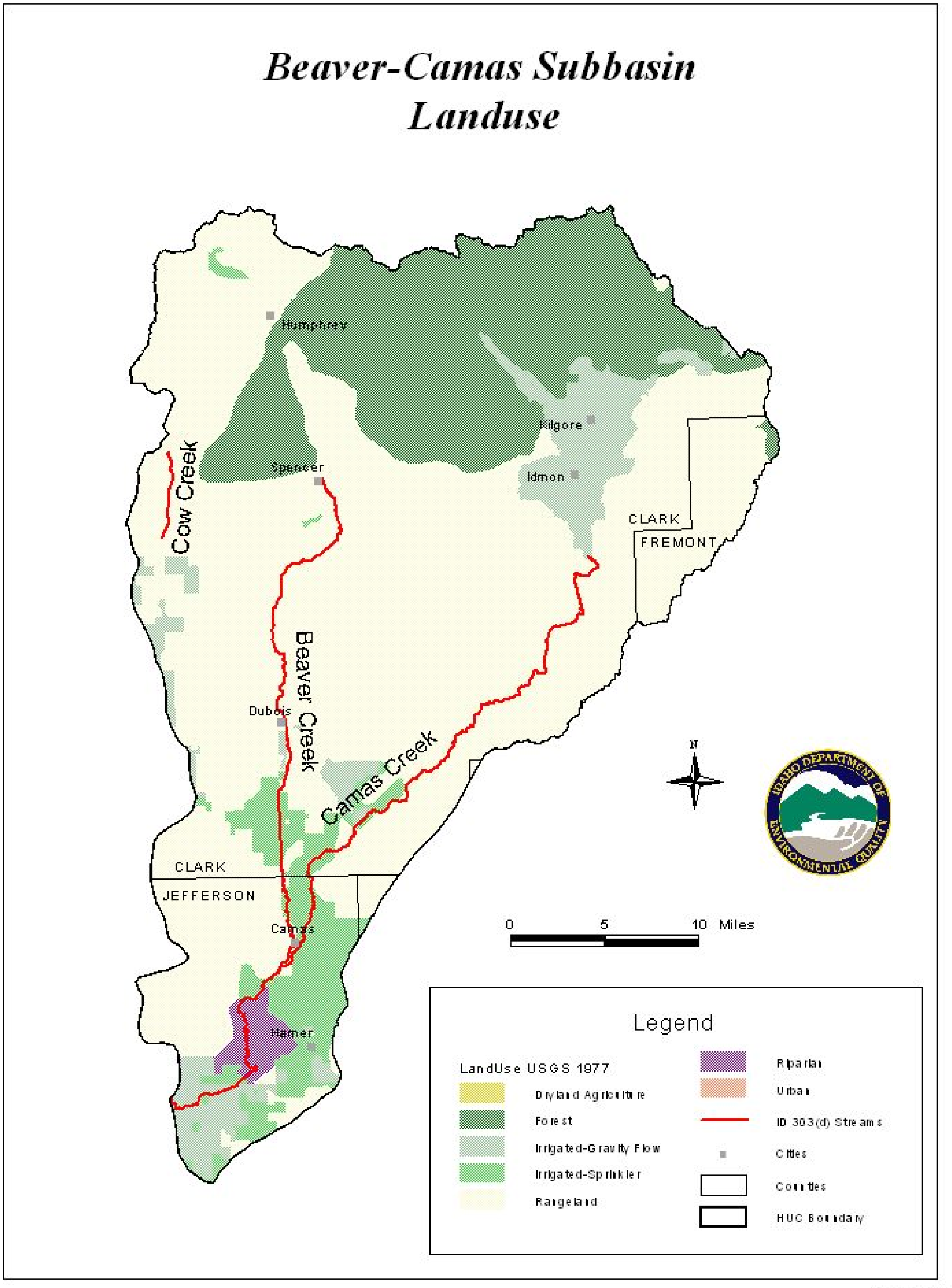


Figure 30. Land Use in the Beaver-Camas Subbasin.

Land Ownership, Cultural Features, and Population

The majority (61%) of landownership in the Beaver-Camas Subbasin is public (Table 10 and Figure 31). The Caribou-Targhee Forest Service manages the high elevation mountainous regions, constituting 28% of the subbasin. Some of this 28% delineated in Figure 31 is a continuous patch of land just north of Dubois. This portion of land, in a low gradient, basalt plane portion of the watershed is the United States Department of Agriculture (USDA) Sheep Experiment Station. Outside of the USFS property, the rest of the subbasin's landownership is a mosaic of private, BLM, and state. The USFWS owns and manages 2% of the land in the subbasin, with the Camas National Wildlife Refuge.

Table 10. Landownership statistics for the Beaver-Camas Subbasin.

Owner	Acres	% of Total
Private	248214	39%
BLM	130975	20%
State of Idaho	74254	12%
US Fish and Wildlife Service	10542	2%
US Forest Service	178592	28%
Water	466	0%
Total	**643043**	**100%**

The Beaver-Camas Subbasin is rural, with very small towns located in Jefferson and Clark Counties (Figure 31). The largest town is Dubois with a 2002 population of 690. The two remaining towns with population data are Hamer and Spencer with populations of 12 and 37, respectively. Figure 31 shows the county boundaries and town locations in the subbasin.

There are no NPDES permitted facilities located in the subbasin, however, there are several Waste Water Land Application (WWLAPP) sites for the treatment of waste water (figure 31). All of the WWLAPP sites, with the exception of one, are owned and operated by a commercial farm for the treatment of potato process water. The commercial sites total 1853 acres, with the majority of the land treatment occurring in southern Clark County. A very small site (49 acres) is located in Dubois, serving as the City of Dubois's facility for treating wastewater effluent.

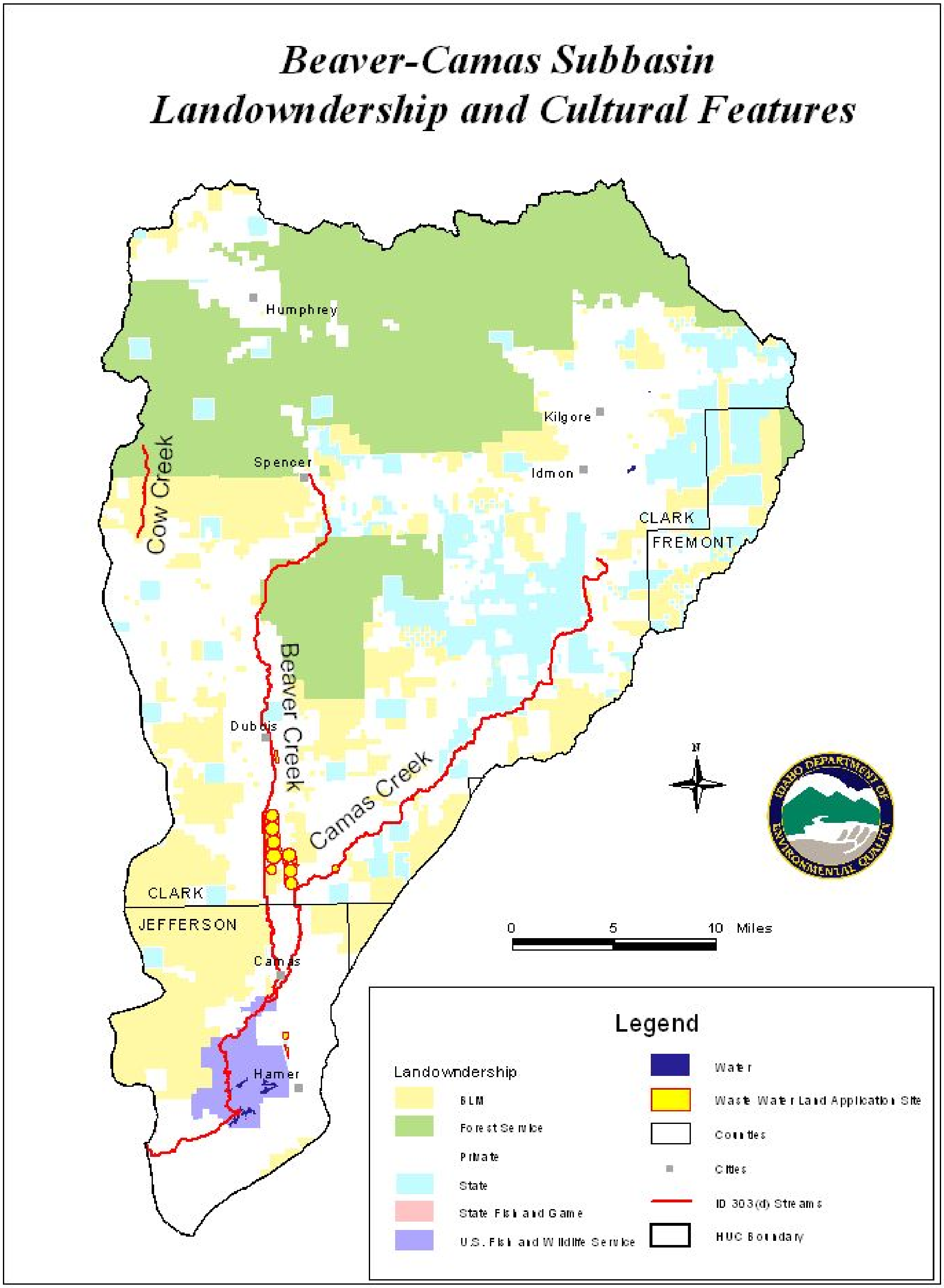


Figure 31. Landownership and Cultural Features of the Beaver-Camas Subbasin.

Mud Lake

Mud Lake, authorized by the Flood Control Act of 1950, is located on the southern tip of the Beaver-Camas watershed, a closed basin on Camas Creek. Mud Lake is Located 20 miles west and 50 miles north of Idaho Falls, in Jefferson County, Idaho. The Lake is formed by a 10-mile-long embankment constructed years ago by local farmers to confine the lake and make it possible to farm the surrounding lands, as well as to provide water elevation so that irrigation canals could deliver water to farms.

Mud Lake is a designated state Wildlife Management Area (WMA), established primarily to preserve and improve nesting habitat for waterfowl. In 1940, the Idaho Department of Fish and Game (IDFG) purchased 607 acres of wetlands, creating Mud Lake WMA. Through the years, acquisition of adjacent land parcels, together with lease agreements and a withdrawal of lands from the U.S. Bureau of Land Management, have expanded Mud Lake WMA to its present 8,853 acres.

Mud Lake is situated on a major Pacific flyway for migratory birds like snow geese, trumpeter swans and ducks. Sand hill cranes, blue herons, and occasionally bald and golden eagles inhabit the area. Moose, elk and antelope are known to be in attendance all year round at the lake. Summer and winter fishing is fantastic, with an exceptional large mouth bass fishery.

Camas National Wildlife Refuge

The Camas national Wildlife Refuge, located off of I-15 near Hamer, Idaho, is one of 500 national wildlife refuges in the country. Each year, during spring and fall, the refuge is filled with migrating songbirds and waterfowls, with numbers peaking at 50,000.

Migratory birds are not the only wildlife that frequent this refuge. Small mammals, such as beavers, coyotes, and cottontails, are often found roaming the fields. Five species of big game also inhabit the area: white-tailed deer, mule deer, pronghorn antelope, moose and elk. Among the endangered and rare species, typical visitors are the bald eagle, peregrine falcon, and trumpeter swan.

About half of the refuge's 10,578 acres are lakes, ponds, and marshlands. The remainder consists of lush grass, sagebrush uplands and meadows.

Water management is a critical component of Camas Refuge operations. An extensive system of canals, dikes, wells, ponds, and water-control structures is used to manipulate water for the benefit of wildlife, with an emphasis on nesting waterfowl. Haying and prescribed fire are used to manipulate vegetation in some fields, and small grain crops are grown to provide supplemental feed for geese and cranes and to keep them from damaging private croplands.

US Sheep Experiment Station

The U.S. Sheep Experiment Station (USSES) is located in the upper Snake River plain at the foothills of the Centennial Mountains, approximately six miles north of Dubois, Idaho, which is the Clark County seat. Clark County contains 1,765 square miles of land and has a population of approximately 980 persons, approximately 500 of whom live in Dubois. The USSES is the second largest employer in Clark County.

In addition to the Dubois location, which serves as the headquarters, the USSES, has research land in two states, Montana and Idaho. The majority of the USSES land is in the Beaver-Camas Subbasin, with smaller portions located close by in Montana. The three locations in the Beaver-Camas Subbasin are the: 1) Headquarters (27,930 acres) near Dubois, 2) Humphrey Ranch (2,600 acres), and 3) the Henninger Ranch near Kilgore (1,200 acres).

The USSES headquarters has office, laboratory, animal, equipment, and residential buildings, dry-lot facilities for research throughout the year, lambing facilities, and lands used for spring and autumn grazing and rangeland research. The Humphrey Ranch has animal facilities and equipment buildings, and is used for spring, summer, and autumn grazing and rangeland research and the Henninger Ranch has animal facilities and is used for summer grazing and rangeland research.

USSES lands range from approximately 4,800 feet to nearly 10,000 feet in elevation, with average annual precipitation that ranges from approximately 10 inches in the Snake River plain to nearly 21 inches in the Centennial Mountains. Because of its diverse geography, USSES lands contain subalpine meadow, foothill, sagebrush steppe, and desert shrubland ecosystems. This diversity provides unparalleled research opportunities.

USSES research will lead to an understanding of the interactions between sheep and the environments in which they are produced that can be used to improve sheep production systems and ensure the sustainability of grazing land ecosystems. (www.ars.usda.gov/main/site_main.htm?modecode=53-64-00-00)

History and Economics

The Beaver-Camas Subbasin is a rural area where the principal economic activities revolve around agriculture. Agriculture has been the principal source of income in the watershed for at least one hundred years.

Dubois, the largest city in the subbasin, is also the Clark County seat. The majority of the population is located in this community and the largest employer is Larsen Farms and the second largest employer in the area is the USSES. The Spencer Opal Mines provide economic opportunities for the residents of Spencer.